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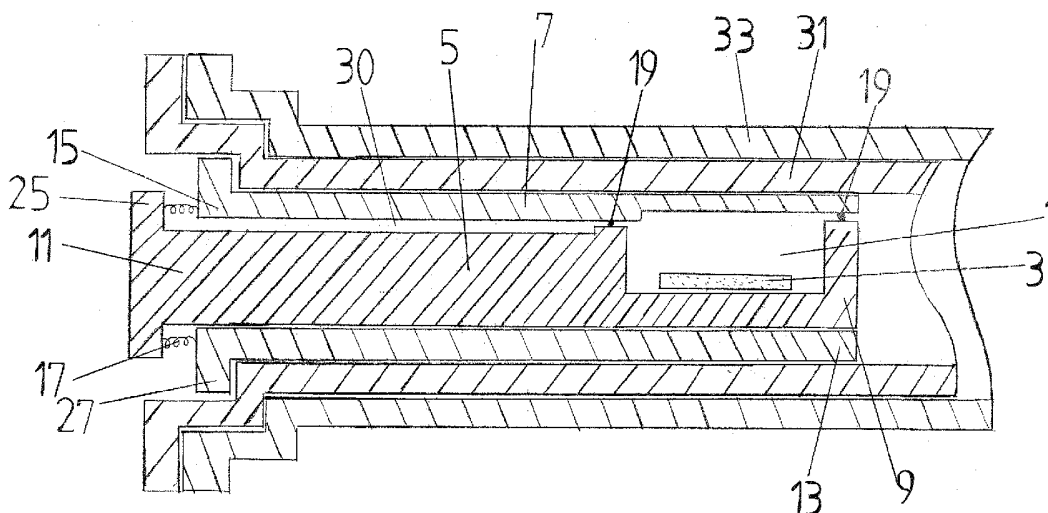
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(54) Title: SOURCE, AN ARRANGEMENT FOR INSTALLING A SOURCE, AND A METHOD FOR INSTALLING AND REMOVING A SOURCE



(57) Abstract: The invention relates to an arrangement for installing a source into a gas deposition reactor. The arrangement comprises at least one source fitting for the source such that the source fitting is connected to a reaction space of the gas deposition reactor, and a source installable at least partly inside the source fitting or a source space connected to the source fitting. According to the invention, the arrangement further comprises reception means in the source fitting for receiving the source, and charging means for installing the source in place in the source fitting for use, and a chamber (1), provided in the source, for a solid or liquid source material (3), and isolating means (7, 19) for isolating the chamber (1) substantially from environment.

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SOURCE, AN ARRANGEMENT FOR INSTALLING A SOURCE, AND A METHOD FOR INSTALLING AND REMOVING A SOURCE

BACKGROUND OF THE INVENTION

The invention relates to a source according to the preamble of claim 1, to an arrangement according to the preamble of claim 18 for installing a source into a gas deposition reactor, and to a method according to the preamble of claim 30 for installing a source into a gas deposition reactor. Particularly, the invention relates to a source for gas deposition methods, which source is insertable at least partly inside a source fitting provided in a gas deposition reactor or a source space connected to the source fitting, to an arrangement for installing a source into a gas deposition reactor, the arrangement comprising at least one source fitting for the source such that the source fitting is connected to a reaction space of the gas deposition reactor, and a source installable at least partly inside the source fitting or a source space connected to the source fitting, and to a method for installing a source into a gas deposition reactor and for removing the same therefrom.

When structures are manufactured by employing gas deposition methods, such as ALD (Atomic Layer Deposition) and other CVD (Chemical Vapor Deposition) methods, source materials are to be brought into a gaseous state prior to feeding them into a reactor space of a reactor. Many processes are provided with no suitable source materials in liquid or gaseous state, so such processes have to utilize solid materials. Since vapour pressures of solid materials are quite low (typically less than 1 mbar at room temperature), they have to be heated in order to achieve a sufficient vapour pressure. Solid sources have thus been developed.

In prior art, solid sources have been tubes that have been placed in an oven and provided with a source crucible therein. In such a solution, a source pipework of a reactor consists of a multi-branch, candelabrum-like pipework, which is preferably made of glass and in which different solid sources reside in different branches that can be heated independently, a reactor space of the reactor being provided at the foot of the candelabrum-like pipework. The process of charging the solid sources is carried out by inserting an open source crucible into a source tube by means of e.g. a thermo-element. In another embodiment, a source crucible was placed in a plastic bag while inserting it into a source tube so as to prevent the source material from becom-

ing oxidized or from reacting with another substance present in room air or, in turn, from evaporating into room air.

A problem with the above-described arrangement is that installing a solid source material into a gas deposition reactor is not an inert procedure, but the arrangement is subject to contamination occurring in connection with installation and removal of the solid source, since the solid source materials used may be highly reactive and sensitive to oxygen and moisture, and they may emit detrimental compounds as vapour. In addition, this prior art solution for installing and removing a solid source is complex, unreliable and difficult to use.

Another prior art solution for installing a solid source into a gas deposition reactor is to utilize a metallic bottle equipped with valves such that a solid source is inserted in the metallic bottle, which, together with the valves, is placed in a vacuum or convection oven. This solution provides an inert method for installing a solid source, but the highest possible operating temperature, approximately 200 to 250°C, is determined by the valves, whose operating life becomes significantly shorter at high temperatures. If the valves are placed outside the oven, additional fittings have to be provided; furthermore, the structure develops heat bridges. In addition, the bottles and parts of the pipework are made of metal, which, due to possible chemical reactions, restricts possible solid source materials available. Furthermore, such bottles, being large and heavy, are difficult to install and detach, and such work also requires tools; in addition, the bottles are expensive. When being replaced, the pipeworks have to be flushed, which makes the solution even more complex.

BRIEF DESCRIPTION OF THE INVENTION

An object of the invention is thus to provide a source, an arrangement for installing a source, and a method for installing and removing a source so as to enable the above-mentioned problems to be solved. The object of the invention is achieved by a source according to the preamble of claim 1, which is characterized in that the source comprises a chamber for a solid or liquid source material, the chamber comprising at least one at least partly open wall, and cover-like isolating means arrangeable onto the wall of the chamber for isolating the chamber from environment, the cover-like isolating means and the chamber being arranged to be slid with respect to one another in order to open and/or close the chamber after the source is installed in the source fitting. The

object of the invention is further achieved by an arrangement according to the preamble of claim 19, which is characterized in that the arrangement comprises reception means in the source fitting for receiving the source, and charging means for installing the source in place in the source fitting for use, and a chamber, provided in the source, for a solid or liquid source material, and cover-like isolating means for isolating the chamber substantially from environment. The object of the invention is further achieved by a method according to the preamble of claim 30, which is characterized by comprising the following steps:

- a) inserting a source, which comprises a substantially from environment isolatably closable and openable chamber for a solid or liquid source material, at least partly inside a source fitting of a gas deposition reactor or a source space connected to the source fitting when the chamber is closed;
- b) closing the source fitting when the source resides in place;
- c) opening the chamber of the source for use of the source material by sliding the chamber and cover-like isolating means arranged onto an at least partly open wall of the chamber with respect to one another;
- d) closing the chamber of the source after using the solid or liquid source material by sliding the chamber and the cover-like isolating means arranged onto the at least partly open wall of the chamber with respect to one another;
- e) opening the source fitting in order to remove the source; and
- f) removing the source from the source fitting of the gas deposition reactor.

Preferred embodiments of the invention are disclosed in the dependent claims.

The invention is based on the idea of providing a source which is insertable at least partly, preferably completely, inside a source fitting provided in a gas deposition reactor, or a receptacle provided in the source fitting, or a connective recess, or a separate space connected to the source fitting and arranged to receive the source. The source comprises a chamber for a solid or liquid source material such that the chamber is normally closed and substantially isolated from environment when no source has been installed in a receptacle of the source fitting provided in the gas deposition reactor. The chamber of the source is formed such that it is still openable and closable when a

source resides in the receptacle of the source fitting. The chamber may be opened automatically while installing the source in the receptacle of the source fitting or in a separate space connected to the source fitting, so that the chamber is also preferably closed when the source is removed from the receptacle or space. On the other hand, the chamber of the source may be opened completely independently of the installation of the source in place; this results in separate means for opening and closing the chamber after the source is installed inside the source fitting. In such an arrangement, the source may comprise special means for isolating the chamber, as well as operating means for opening and/or closing the chamber equipped with special means. The source fitting, in turn, may further be provided with charging means for installing and/or locking the source in place in the source fitting and/or for closing and sealing a receptacle of the source when the source resides in the receptacle. Alternatively, the aforementioned charging means as well as can be provided in connection with a separate space wherein a solid source is installable.

In the present context, a chamber refers to a space provided in a source and capable of receiving a source material. Hence, the shape, structure and properties of a chamber may vary as long as it is capable of receiving a source material being used. The chamber comprises at least one at least partly open wall which is closable and/or isolatable by means of cover-like isolating means which can be arranged onto the open wall of the chamber in order to isolate the chamber from environment. The chamber and the cover-like isolating means, in turn, are provided such that they are capable of sliding with respect to one another in order to open and close the chamber. Preferably, the isolating means and the chamber or the structure containing the chamber comprise sliding surfaces which slide against one another. In other words, the chamber is sealed by means of the sliding surfaces provided between the structure of the chamber and the isolating means. In the structure according to the invention, the direction of the open wall of the chamber, i.e. the opening direction, and the direction of movement of the chamber and/or the isolating means are preferably at an angle of approximately 90°C with respect to one another.

In the present context, a source refers to a solid source for solid source materials or to a liquid source for liquid source materials. A solid material and a liquid material, in turn, refer to materials that are under normal conditions (NTP condition, pressure 1 atm and temperature 0°C).

An advantage of the solution according to the invention is that it provides a source which operates like a cartridge, including all that is necessary for use. When the chamber of the source is isolated substantially from environment as well as controllably openable and closable, the solution according to the invention needs no valves, which enables even extremely high temperatures to be used which, in turn, enhances the range of source materials available. Furthermore, a simple cartridge-like structure allows a source to be replaced quickly and easily. Due to an isolated and, when desired, openable and closable chamber, a source can be replaced inertly, since the chamber can be kept isolated prior to installing the source, and it can be isolated again when the source is removed from a source fitting. Furthermore, a source according to the invention is inexpensive to manufacture, and it can be made from a completely inert material, such as glass. The source according to the invention enables small amounts of expensive/difficult-to-synthesize source materials which, in addition, can be kept constantly fresh. The structure of the source may also be connected with a secure source technology for inert transfer of source materials, which, in turn, reduces safety risks.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described in closer detail in connection with preferred embodiments and with reference to the accompanying drawing, in which

Figure 1 schematically shows an embodiment of the present invention wherein a source has been installed in a source fitting.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 schematically shows a cross-section of an embodiment according to the present invention after a source is installed inside a source fitting. In the case of Figure 1, the source has been placed inside the source fitting but it has not yet been installed in an operating position, but it is ready for final installation.

The embodiment of Figure 1 shows a source for gas deposition methods, the source being placed inside a source fitting provided in a gas deposition reactor. The source comprises a bar element 5 which has a first end 11 and a second end 9 and which, at the second end 9 or in the vicinity thereof, is provided with a chamber 1. The bar element, and thus also the

chamber 1, is preferably made of glass, since glass is a very inert material which does not cause reactions during use of the source and which enables high operating temperatures. Preferably, the chamber 1 is provided in the vicinity of the second end 9 of the bar element 5 while manufacturing the bar element 5, or, alternatively, it has been worked therein by gouging. The bar element 5 is placed in the source fitting in accordance with Figure 1, with its second end 9 first. The chamber 1 operates as a source crucible arranged to receive a solid or liquid source material 3 used in the gas deposition method. The size and shape of the bar element 5 and the chamber 1 provided therein may be selected as desired. In this embodiment, the bar element 5 is an elongated bar with a substantially circular cross-section.

In accordance with the invention, the chamber 1 provided in the bar element 5 is isolated by means of isolating means when no source has been installed in place in its operating position. The isolating means comprise a tube 7, or a tubular sleeve, which has a first end 15 and a second end 13 and which can be arranged around the bar element 5 such that it isolates the chamber 1 substantially from environment. The tube 7 may be arranged onto the bar element 5 over its entire length or over a section of the length of the bar element 5 only. The point is that the tube 7 settles at least over the chamber 1 provided in the bar element 5 when no source has been installed in its operating position inside the source fitting. The tube 7 is preferably dimensioned with respect to the bar element 5 such that it fits tightly around the bar element 5 so as to be capable of isolating the chamber 1 substantially from environment. The tube 7 is also preferably made of glass, so that it also contributes to ensuring the inertness of the source and the chamber 1 during use.

As shown in Figure 1, the isolating means may further comprise seals 19 provided in the bar element 5 on both sides of the chamber 1 in a longitudinal direction of the bar element 5 such that the seals 19 are pressed against an inner surface of the tube 7 when the tube 7 resides on the bar element 5. The seals 19 may also be provided only on one side of the chamber 1 in the longitudinal direction of the bar element 5. Furthermore, it is possible to similarly provide the tube 7, rather than the bar element 5, with seals 19. The seals may consist e.g. of elastomer or graphite seals or other corresponding seals which are capable of sealing the chamber 1 off from environment.

In the embodiment shown herein, the bar element 5 is longer than the tube 7, so that the chamber 1 may be opened by pushing the bar element

5 into the tube 7 until the second end 9 of the bar element protrudes out of the second end 13 of the tube 7. Consequently, the chamber 1 provided at the second end 9 of the bar element 5 at least partly protrudes out of the second end 13 of the tube 7, opening the chamber 1 and presenting the solid or liquid source material 3 contained therein. Similarly, the chamber 1 can be closed by drawing the bar element 5 into the tube 7 such that the second end 9 of the bar element 5 withdraws into the tube 7. In such a case, the chamber 1 closes and enters a state of isolation from environment.

The source may further comprise operating means for opening and/or closing the isolated chamber 1 after the source is installed in the source fitting. In the present embodiment, the operating means are provided such that the isolating means, the tube 7, are movable by the operating means with respect to the chamber 1 or the bar element 5, or that the chamber 1 or the bar element 5 is movable by the operating means with respect to the isolating means, the tube 7, in order to open and/or close the chamber 1, which is substantially isolated from environment. In the solution according to Figure 1, the operating means are provided such that the bar element 5 is movable in a direction of its longitudinal axis with respect to the tube 7, or that the tube 7 is movable in a direction of its longitudinal axis with respect to the bar element 5 in order to open and/or close the chamber 1, which is substantially isolated from environment. In the solution of Figure 1, the operating means for opening and/or closing the chamber 1 comprise a first flange 25 arranged in the first end 11 of the bar element 5, and a second flange 27 arranged in the first end 15 of the tube 7, a spring 17 being provided between the first flange 25 of the bar element 5 and the second flange 27 of the tube 7. The spring 17 is installed such that when the spring 17 is in an uncompressed state, as shown in Figure 1, the chamber 1 is in a state of substantial isolation from environment and closed, and when the spring 17 is in a compressed state, the chamber 1 is at least partly open. The spring 17 may also be arranged in another, alternative way which enables the chamber 1 to be opened and closed.

The operating means may further comprise means for compressing the spring 17 to open the chamber 1 and/or for releasing the spring 17 to close the chamber 1. These means may be provided in the source or, alternatively, in a source fitting of a gas deposition reactor, for instance. The means may operate e.g. such that while installing the source in place in the source fitting, these means open the chamber automatically for use, and when removing the

source from the chamber 1, these means automatically close the chamber into an isolated state. The means then e.g. compress the spring 17, thus pushing the second end 9 of the bar element 5 out of the second end 13 of the tube 7, thereby opening the chamber when the source is being installed in the source fitting. Similarly, these means release the spring 17 when the bar element 5 is being removed from the source fitting, thereby closing the chamber 1.

The bar element 5 may still further comprise a channel 30 for a flow of a carrier gas, flushing gas or the like to be conducted over the chamber 1. This channel enables e.g. a gas flow to be fed between the tube 7 and the bar element 5 such that the gas flow passes over the open chamber 1 in order to convey the source material into a reaction space of a reactor.

The bar element 5 and the tube 7 may also be designed such that the bar element 5 is rotatable around its longitudinal axis with respect to the tube 7, or that the tube 7 is rotatable around its longitudinal axis with respect to the bar element 5 in order to open and/or close the chamber 1, which is substantially isolated from environment. In such a case, the tube 7 may be provided with an opening or indentation which, by the operating means, is movable so as to reside at the chamber 1 and/or away therefrom in order to open and/or close the chamber 1. In the case according to Figure 1, the tube 7 may comprise an opening which, when the chamber 1 is isolated, resides below the bar element, in which case the chamber 1 is closed, and which, when the chamber 1 is open, resides above the chamber 1, thereby opening the chamber 1. Instead of an opening, an indentation provided at the second end 13 of the tube 7 may, for instance, be used, so that the indentation extends from the edge of the second end 13 of the tube 7 towards the first end 15. This further enables operating means to be provided for rotating the tube 7 and the bar element 5 relatively.

In accordance with the present invention, the operation of the source may also be such that the bar element 5 is movable in the direction of its longitudinal axis with respect to the tube 7, or that the tube 7 is movable in the direction of its longitudinal axis with respect to the bar element 5, and that the bar element 5 is rotatable in the direction of its longitudinal axis with respect to the tube 7, or that the tube 7 is rotatable in the direction of its longitudinal axis with respect to the bar element 5 in order to open and/or close the chamber 1, which is substantially isolated from environment. Hence, in order to open and close the chamber 1, the relative longitudinal movement and

the relative rotating movement around the longitudinal axis of both the tube 7 and the bar element 5 are combined. This may further be carried out by the operating means provided for opening and closing the chamber 1.

In all the above-described cases, the operating means may be formed as independent means such that they are connected to control means provided in a gas deposition reactor to enable the operating means to be activated in order to open and/or close the chamber 1. In such a case, the operating means may be manually, electrically, or otherwise similarly operable.

Similarly, the carrier gas flow may be conveyed through the inside of the source or on the surface thereof, i.e. either between the tube and the bar element or on the outer surface of the tube.

An end of the tube or a portion thereof, preferably in the vicinity of the second end 13 of the end may also be made of a porous material, such as sinter, so that this porous section may be turned to reside at the chamber so as to enable the source material to flow through the porous section. The chamber thus opens to the surrounding space via this porous section, which may also serve as a filter. This enables disadvantages due to dusting of the source material to be avoided.

In accordance with the present invention, a source may be implemented in a number of alternative ways, one example thereof given above. The most important point in the invention is that the source comprises a chamber which is capable of receiving a solid or liquid source material and wherein it can be isolated substantially from environment. The source is further implemented such that the solid or liquid material may be inserted into a gas deposition reactor as isolated from environment, and that after the source is installed in its place in the reactor, the chamber may be opened for use. Furthermore, the invention is advantageous in that the chamber may be closed back into the isolated state when it is removed from the reactor. The source thus operates in a cartridge-like manner, being inserted in a receptacle provided in the reactor, wherein it is opened for use and closed after use and wherefrom it is removed after use. The source thus comprises structures necessary for enabling the source to be used without any separate isolating means or valves. It is thus obvious that it is not necessary to manufacture the source as an elongated structure according to Figure 1, but the shape and structure thereof, as well as the isolation arrangements and operating means and methods for opening the chamber, may vary. It is not necessary to insert the source completely inside

the source fitting of the reactor, but it may be inserted therein only as far as the chamber is concerned. In addition, when necessary, the shape and structure of sources to be installed even in the same source fitting may vary according to the properties of a given source material.

Alternatively, the cover-like isolating means in the form of a tube 7 may also be replaced by plate-like, flat, curved, etc. covers which may be installed onto the open wall of the chamber in order to isolate the chamber from environment. As in the case in connection with the tube 7, a cover is also arranged to slide with respect to the chamber in order to open and close the chamber. Consequently, the sliding surfaces of the chamber or its structure and the cover slide against one another. According to the invention, the cover or tube 7 may slide completely or partly off from the top of the open wall of the chamber, or, similarly, the cover and/or tube and/or the chamber may be formed such that when they move with respect to one another, a flow path opens up from the chamber even if the cover or tube does not even partly move off from top of the open wall of the chamber. In such a case, a gap may occur between the structure/edges of the chamber and the cover or tube, through which the source material is allowed to flow out of the chamber.

According to the present invention, an arrangement may further be provided for installing a source into a gas deposition reactor. The arrangement comprises at least one source fitting connected to a reaction space of the gas deposition reactor for a source, and a source installable at least partly inside the source fitting. The source to be used is preferably as described above but, alternatively, it may also be different.

This arrangement comprises reception means, provided in the source fitting, for receiving the source, and charging means for installing the source in place in the source fitting for use, and a chamber 1 provided in the source for a solid or liquid source material 3, and isolating means 7, 19 for isolating the chamber 1 substantially from environment. The isolating means 7, 19 are formed such that the isolation of the chamber 1 is optionally openable and/or closable when the source resides in the source fitting.

The reception means provided in the source fitting comprise a connective recess or receptacle defined by tubular parts 31 and 33 and arranged to receive a source. Preferably, the inner tubular part 31 and the outer tubular part 33 are made of metal such that the source fitting they partly constitute is still connected to the reactor space of the gas deposition reactor. The recep-

tion means may also form a receptacle of another type which is able to receive a source.

The charging means provided in the source fitting are arranged to lock the source in place in the source fitting, and to open the locking of the source and/or to close and open the receptacle of the source fitting. The charging means preferably comprise a hatch which, in the solution according to Figure 1, may be arranged on top of the bar element 5 of the source and the first ends 11 and 15 of the tube 7 such that the source fitting closes, whereby the source completely remains inside the source fitting. The hatch is preferably manually operated, so it is quick and easy to open and close. Alternatively, the hatch may be such that it is used by separate means e.g. electrically. In the embodiment of Figure 1, the hatch may also be made to open the isolation of the chamber 1 of the source when the source fitting is being closed and/or to close the isolation of the chamber when the source fitting is being opened. In such a case, closing and opening the hatch generates a relative movement of the bar element and the tube so that the chamber 1 opens. Use of the charging means then makes the operating means to open and close the chamber, which is isolated by the isolating means 7, 19. In Figure 1, the hatch compresses the spring 17, whereupon the bar element 5 protrudes out of the second end 13 of the tube 7, thereby opening the chamber 1. The hatch may be further equipped with seals to seal the source fitting when the hatch is being closed. Alternatively, the charging means may be provided such that the source is locked automatically into the receptacle of the source fitting when it is pushed into place, whereby the locking of the source may be opened using a separate push button or the like. Alternatively, the charging means may be completely electrically-operated such that they lock the source in its operating position and release it therefrom.

However, the arrangement may also comprise separate operating means provided in the source fitting in order to open and/or close the chamber 1 of the source from the isolation provided by isolating means. The procedures of opening and closing the chamber 1 are then completely independent of the installation of the source in the source fitting. In such a case, a user is also free to open and close the chamber 1 in accordance with the desired operating sequences, with no need to necessarily remove the source from the source fitting in order to close the chamber 1.

The arrangement may further comprise at least one set of gas feeding means for blowing a carrier gas, flushing gas or the like to the source fitting, preferably between the bar element 5 and the tube 7. The source fitting may further be provided with heating means for heating the solid or liquid source material contained in the chamber of the source. The heating means may be e.g. resistors. After the source is installed in the source fitting, the source may be completely isolated from environment by using an isolation arrangement. For this purpose, the aforementioned hatch or another isolation arrangement may be employed to reduce or eliminate a contamination risk when the source resides in place in the source fitting.

In the method according to the present invention for installing a source into a gas deposition reactor and removing the same therefrom, the source, which comprises a substantially from environment isolatably closable and openable chamber for a solid or liquid source material, is first inserted at least partly, i.e. inside at least a portion of the chamber, inside the source fitting of the gas deposition reactor when the chamber is closed. Next, the source fitting is closed and the chamber of the source is opened to enable the source material to be used. After using the source or in order to stop the use of the source, the chamber of the source is closed and the source fitting is opened for removal of the source, after which the source is removed from the source fitting of the gas deposition reactor. In addition, when the source resides in place and the chamber is open, the method may include feeding a carrier gas over the chamber for utilizing the solid or liquid source material.

However, it is to be noted that the arrangement may also comprise a separate space connected to the source fitting, in which the source can be installed. In such a case, the source may be installed at least partly inside this space. This space may be any charging space arranged to receive a source and connected to a source fitting, or even directly to a reaction space. Otherwise this space may operate in a manner similar to that described in connection with the source fitting above.

In the method, the procedures of opening the chamber and closing the source fitting as well as closing the chamber and opening the source fitting may be combined such that closing the source fitting opens the chamber automatically, and that opening the source fitting, in turn, closes the chamber automatically. On the other hand, the procedures of opening and closing the chamber may be completely independent procedures that are not associated

with closing or opening the source fitting. Hence, the chamber of the source may be opened and closed while it resides in the source fitting, in accordance with the desired operating sequences. When desired, the method of the invention may be used when replacing a source and, particularly, a solid or liquid source material being used. The method may be applied in closer detail in connection with the source and arrangement described above by employing the structural properties disclosed therein.

It is apparent to a person skilled in the art that as technology advances, the basic idea of the invention may be implemented in many different ways. The invention and its embodiments are thus not restricted to the above-described examples but may vary within the scope of the claims.

CLAIMS

1. A source for gas deposition methods, the source being insertable at least partly inside a source fitting provided in a gas deposition reactor or a source space connected to the source fitting, **characterized** in that the source comprises a chamber (1) for a solid or liquid source material (3), the chamber (1) comprising at least one at least partly open wall, and cover-like isolating means arrangeable onto the wall of the chamber (1) for isolating the chamber from environment, the cover-like isolating means and the chamber (1) being arranged to be slid with respect to one another in order to open and/or close the chamber (1) after the source is installed in the source fitting.

2. A source as claimed in claim 1, **characterized** in that operating means are provided such that the cover-like isolating means are movable by the operating means with respect to the chamber (1), or that the chamber (1) is movable by the operating means with respect to the isolating means in order to open and/or close the chamber (1), which is substantially isolated from environment.

3. A source as claimed in claim 1 or 2, **characterized** in that the chamber (1) is a source crucible arranged to receive a solid or liquid source material (3).

4. A source as claimed in any one of claims 1 to 3, **characterized** in that the source comprises a bar element (5) which has a first end (11) and a second end (9) and which, at the second end (9) or in the vicinity thereof, is provided with a chamber (1).

5. A source as claimed in any one of claims 1 to 4, **characterized** in that the cover-like isolating means further comprise seals (19) provided in the bar element (5) on at least one side of the chamber (1) in a longitudinal direction of the bar element such that the seals (19) are pressed against an inner surface of a tube (7) after the tube (7) is arranged onto the bar element (5).

6. A source as claimed in any one of claims 4 to 6, **characterized** in that the operating means are provided such that the bar element (5) is movable in a direction of its longitudinal axis with respect to the cover-like isolating means, or that the cover-like isolating means are movable in the direction of the longitudinal axis of the bar element (5) with respect to the bar

element (5) in order to open and/or close the chamber (1), which is substantially isolated from environment.

7. A source as claimed in any one of claims 1 to 6, **characterized** in that the cover-like isolating means comprise a tube (7) which has a first end (15) and a second end (13) and which is arrangeable at least partly around the bar element (5) such that it isolates the chamber (1) substantially from environment.

8. A source as claimed in any one of claims 1 to 6, **characterized** in that the cover-like isolating means comprise a substantially planar or curved cover, which is arrangeable at least partly onto the open wall of the chamber (1) such that it isolates the chamber (1) substantially from environment.

9. A source as claimed in claim 7, **characterized** in that the bar element (5) is longer than the tube (7), so that the chamber (1) is openable or, similarly, closable such that the bar element (5) is movable in the direction of its longitudinal axis inside the tube (7) until at least a portion of the chamber (1) provided at the second end (9) of the bar element (5) or in the vicinity thereof protrudes out of the second end (13) of the tube (7) or, similarly, until the chamber (1) is completely withdrawn into the tube (7) again.

10. A source as claimed in any one of claims 7 to 9, **characterized** in that the operating means for opening and/or closing the chamber (1) comprise a first flange (25) arranged in the first end (11) of the bar element (5), and a second flange (27) arranged in the first end (15) of the tube (7) or cover, the operating means comprising at least one spring (17) provided between the first flange (25) of the bar element (5) and the second flange (27) of the tube (7) or cover.

11. A source as claimed in claim 10, **characterized** in that when the spring (17) is in an uncompressed state, the chamber (1) is in a state of substantial isolation from environment and closed, and when the spring (17) is in a compressed state, the chamber (1) is at least partly open.

12. A source as claimed in claim 10 or 11, **characterized** in that the operating means further comprise means for compressing the spring (17) in order to open the chamber (1) and/or for releasing the spring (17) in order to close the chamber (1).

13. A source as claimed in any one of claims 4 to 6, **characterized** in that the operating means are provided such that the bar element

(5) is rotatable around its longitudinal axis with respect to the tube (7) or cover, or that the tube (7) or cover is rotatable around the longitudinal axis of the bar element (5) with respect to the bar element (5) in order to open and/or close the chamber (1), which is substantially isolated from environment.

14. A source as claimed in claim 8 or 13, **characterized** in that the tube (7) is provided with an opening, indentation, or a porous area which, by the operating means, is movable so as to reside at the chamber (1) and/or away therefrom in order to open and/or close the chamber.

15. A source as claimed in any one of claims 4 to 6, **characterized** in that the operating means are provided such that the bar element (5) is movable in the direction of its longitudinal axis with respect to the tube (7) or cover, or that the tube (7) or cover is movable in the direction of the longitudinal axis of the bar element (5) with respect to the bar element (5), and that the bar element (5) is rotatable around its longitudinal axis with respect to the tube (7) or cover, or that the tube (7) or cover is rotatable around the longitudinal axis of the bar element (5) with respect to the bar element (5) in order to open and/or close the chamber (1), which is substantially isolated from environment.

16. A source as claimed in any one of claims 1 to 15, **characterized** in that the operating means are connected to control means provided in the gas deposition reactor so as to enable the operating means to be activated in order to open and/or close the chamber (1).

17. A source as claimed in any one of claims 1 to 16, **characterized** in that the chamber (1) and/or the bar element (5) and/or the cover-like isolating means are at least partly made of glass.

18. A source as claimed in any one of claims 1 to 17, **characterized** in that the bar element (5) further comprises a channel (30) for a flow of a carrier gas, flushing gas or the like to be conducted over the chamber (1).

19. An arrangement for installing a source into a gas deposition reactor, the arrangement comprising at least one source fitting for the source such that the source fitting is connected to a reaction space of the gas deposition reactor, and a source installable at least partly inside the source fitting or a source space connected to the source fitting, **characterized** in that the arrangement comprises reception means in the source fitting for receiving the source, and charging means for installing the source in place in the source fit-

ting for use, and a chamber (1), provided in the source, for a solid or liquid source material (3), and cover-like isolating means (7, 19) for isolating the chamber (1) substantially from environment.

20. An arrangement as claimed in claim 19, **characterized** in that the cover-like isolating means (7, 19) are provided such that the isolation of the chamber (1) is optionally openable and/or closable when the source resides in the source fitting by sliding the cover-like isolating means and the chamber (1) with respect to one another.

21. An arrangement as claimed in claim 19 or 20, **characterized** in that the arrangement further comprises operating means, provided in the source, for opening and/or closing the chamber (1) isolated by the cover-like isolation means (7, 19).

22. An arrangement as claimed in any one of claims 19 to 21, **characterized** in that the reception means comprise a connective recess or receptacle for receiving the source and/or at least the chamber (1) of the source.

23. An arrangement as claimed in any one of claims 19 to 22, **characterized** in that the charging means are arranged to lock the source in place in the source fitting and to open the locking of the source.

24. An arrangement as claimed in claim 23, **characterized** in that the charging means are further arranged to open the isolation of the chamber (1) of the source when the source fitting is being closed and/or to close the isolation of the chamber when the source fitting is being opened.

25. An arrangement as claimed in claim 23 or 24, **characterized** in that the charging means are manually-operated.

26. An arrangement as claimed in any one of claims 23 to 25, **characterized** in that the charging means comprise a hatch for locking the source inside a receptacle provided in the source fitting.

27. An arrangement as claimed in claim 19 or 20, **characterized** in that the arrangement comprises separate operating means, provided in the source fitting, for opening and/or closing the isolation of the chamber (1) of the source provided by the isolating means.

28. An arrangement as claimed in claim 19 to 27, **characterized** in that the arrangement further comprises at least one set of gas feeding means for blowing a carrier gas, flushing gas or the like into the source fitting.

29. An arrangement as claimed in claim 19 to 28, **characterized** in that the arrangement further comprises heating means, provided in the source fitting, for heating the solid or liquid source material contained in the chamber of the source.

30. A method for installing a source into a gas deposition reactor and for removing the same therefrom, **characterized** in that the method comprises the following steps:

a) inserting a source, which comprises a substantially from environment isolatably closable and openable chamber for a solid or liquid source material, at least partly inside a source fitting of a gas deposition reactor or a source space connected to the source fitting when the chamber is closed;

b) closing the source fitting after the source is installed in place;

c) opening the chamber of the source in order to use the source material by sliding the chamber and cover-like isolating means arranged onto an at least partly open wall of the chamber with respect to one another;

d) closing the chamber of the source after using the solid or liquid source material by sliding the chamber and the cover-like isolating means arranged onto the at least partly open wall of the chamber with respect to one another;

e) opening the source fitting in order to remove the source; and

f) removing the source from the source fitting of the gas deposition reactor.

31. A method as claimed in claim 30, **characterized** in that steps b) and c) as well as steps d) and e) are combined such that closing the source fitting automatically opens the chamber, and that opening the source fitting, in turn, automatically closes the chamber.

32. A method as claimed in claim 30, **characterized** in that the chamber of the source, while it resides in the source fitting, is opened and closed in accordance with operating sequences as desired.

33. A method as claimed in claim 30 or 31, **characterized** in that the method is applied to replacing a source in a source fitting.

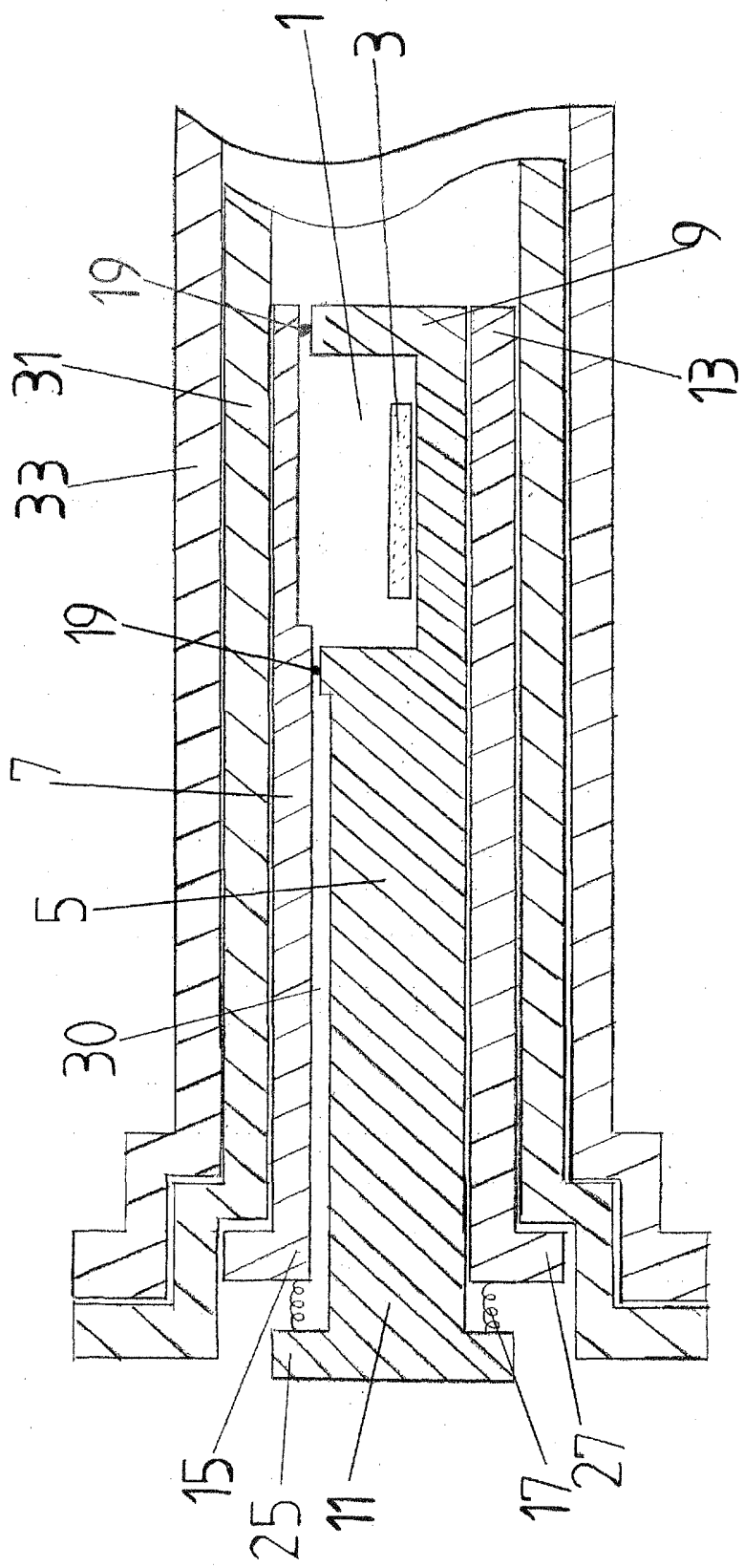


FIG.1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2006/050159

A. CLASSIFICATION OF SUBJECT MATTER		
See extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC8: C23C, C30B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
FI, SE, NO, DK		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPOQUE-Internal, WPI, INSPEC, EPOQUE-NPL, EPOQUE-XPESP		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6162300 A (BICHRT CRAIG E) 19 December 2000 (19.12.2000), Col. 2, lines 13-25; Col. 5, lines 33-50; Col. 10, lines 40-48; Fig. 1; Claims	1-3, 19-23, 30, 32, 33
X	US 4543467 A (EISELE IGNAZ et al.) 24 September 1985 (24.09.1985), Col. 5, lines 10-35; Figs. 1-4; Claims	1-3
A	US 4607152 A (ALLOVON MICHEL et al.) 19 August 1986 (19.08.1986), Detailed description; Figs. 1-2	1-3, 19-25, 30, 32, 33
A	SERGHINI-MONIM, S. et al. New doser for chemical vapor deposition of low vapor-pressure solid precursors. Rev. sci. instrum. October 1996, Vol. 56, No. 10, pages 3672-3674, ISSN 0034-6748., Section II; Fig. 2	1-9, 13-25, 28-33
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
06 July 2006 (06.07.2006)		14 July 2006 (14.07.2006)
Name and mailing address of the ISA/FI National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328		Authorized officer Jani Päiväsaari Telephone No. +358 9 6939 500

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2006/050159

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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

C23C 16/00 (2006.01)**C23C 16/44** (2006.01)**C23C 16/455** (2006.01)**C30B 25/00** (2006.01)**C23C 14/00** (2006.01)**C23C 14/24** (2006.01)