Patent specification

【Title】BUSH UNIT USED FOR PLASMA REACTION DEVICE

【Technical field】

【0001】 The present invention relates bush unit using for plasma reaction device, it specifically relates to a replaceable bush unit.

【Description of related art】

【0002】 Today, plasma reaction technique has been widely applied in different kinds of industries such as semiconductor manufacturing industry, display panel manufacturing industry and solar cell manufacturing industry. Generally speaking, plasma reaction device is formed by a plurality of chambers (materials include aluminum alloy or stainless steel), meanwhile, on the inner wall of the chamber, it is usually coated with protective film or aluminum oxide or ceramic layer so as to achieve the effect of insulation as well as anti-plasma corrosion.

【0003】 Plasma reaction chamber is usually used in the manufacturing art of all kinds of electronic devices, for example, etching process, chemical vapor deposition (CVD) process and other processes related to the manufacturing of electronic device on the substrate. Meanwhile, several methods are used to generate and/or control plasma density, shape and electric characteristics within reaction chamber, for example, capacitive or inductive coupling RF source that is generally used in regular plasma chamber. For example, during plasma assisted chemical vapor deposition (PECVD) process, reaction gas is introduced into reaction chamber through capacitive coupling

nozzle, and the nozzle is installed above the semiconductor substrate that is surrounded by process accessories. Once plasma is formed within PECVD chamber, plasma will react with reaction gas and substrate so as to deposit expected material layer on the substrate. Generally speaking, the characteristics of plasma formed in the plasma formation zone can improve the deposition, etching and/or cleaning process partly implemented in the substrate or reaction chamber deployed in the downstream of plasma formation zone.

【0004】 In the regular plasma reaction chamber design, the plasma formed is deployed above the surface of the substrate, and such design will usually cause unwanted sputtering and damage on the surface of the substrate. This is caused by the interaction between the electron and ion formed in the plasma and the substrate surface. The ionized ions of the formed plasma and the electric grounding part basically will be accumulated with electric charges. And the formed net electric charge will cause electrons and/or ions formed in the plasma to bombard the substrate or the exposed surface of the chamber part, meanwhile, it could possibly cause damage to the substrate or the exposed surface of the chamber part. Therefore, in some applications, it is hoped that gas free radical with energy sufficient to get easy reaction with substrate surface (or the surface of chamber part) is expected to be formed so as to reinforce the reaction rate but in the meantime will not bombard the substrate or surface of chamber part strongly, because, non-ionized gas free radical will not be affected by electric charge formed on the substrate or part surface. However, it was found that when plasma reaction chamber with coated layer is used, serious process drift might occur. The process drift might be due to interaction between excited

gas, through defects in the coated layer (for example, the porosity or crack in the coated layer), and the surface of structural metallic part. The issues of coated layer are especially serious when iso-ionic body contains oxide material or fluoride material (such material tends to attack most of the commonly used metallic materials), and it could mostly occur in the unit joining site.

【0005】 Therefore, plasma reaction device must be periodically maintained and repaired, meanwhile, the coated layer on the inner wall of reaction chamber must be totally removed, for example, through the use of chemical etching, sand blasting, polishing or milling methods, etc. However, when different methods are used to remove the coated layer, it might cause damage on the reaction chamber, for example, it could lead to the thinning of the wall of reaction chamber. In another part, when the inner wall of reaction chamber is constantly bombarded by the plasma ion, it could also lead to the partial damage on the chamber wall. Based on the above reasons, after plasma reaction device is used for a period of time, it is needed to replace the damaged chamber. In addition, when the damaged part of the chamber occurs at the joining part between chambers, it will lead to bad airtightness between chambers or magnetic field drift during plasma reaction, consequently, it could lead to the reduction of the plasma generation efficiency and the situation of insufficient uniformity.

【0006】 Furthermore, please refer to figure 1, which shows a conventional plasma reaction device 10. One part of the plasma reaction device 10 is formed by three-piece chamber, which is first chamber 11, second chamber 12 and third chamber 13 as shown in figure 1. In today’s market, for manufacturing and assembly convenience, the respective joining surface of the

first chamber 11 of the plasma reaction device 10 to the second chamber 12 and the third chamber 13 is usually designed as of the same configuration, for examples, both faces are designed as of male heads to be inserted to inner sides of the second chamber 12 and the third chamber 13, or both faces are designed as of female heads to accommodate part of the second chamber 12 and the third chamber 13.

【0007】 However, according to the principle of plasma process, the plasma reaction device 10, during its operation, will generate magnetic line of force of certain direction, which could lead to the damage of one of the joining faces of the first chamber 11 having both faces of the same configurations. Based on the above mentioned reasons, since the damage part of chamber occurs at the joining site between chamber and chamber, therefore, it could also lead to bad airtightness between chambers or the magnetic field drift during the plasma reaction, consequently, the plasma generation efficiency in the subsequent use might be reduced, or the situation of insufficient uniformity might occur. Therefore, after long term use, it is needed to replace the damaged chamber, which could lead to the increase of manufacturing cost.

【0008】 Therefore, it is needed to provide a plasma reaction device, which will not lead to the need of the replacement of the entire chamber with damaged part due to damage of partial inner wall of chamber. In another aspect, the plasma reaction device can follow the direction of magnetic line of force generated during real manufacturing status to change accordingly more appropriate configuration for the joining faces between chambers, which in turn will enhance the usage lifetime of the chamber of plasma reaction device.

【Summary of the invention】

【0009】 In order to solve the above mentioned prior art issue, one objective of the present invention is to provide a bush unit used in plasma reaction device installing at the inner side wall of chamber of plasma reaction

device, meanwhile, the bush unit is of replaceable type, in one aspect, it can protect the inner side wall of chamber of plasma reaction device from damage due to plasma bombardment, or from damage of chamber wall during the removal of the coated layer, in another aspect, it allows, based on real application need, the setup of the joining face between chambers to satisfy the magnetic line of force of plasma reaction and configuration of gas field principle.

【0010】 In order to achieve the above mentioned objectives, the present invention provides a bush unit used in plasma reaction device having a first chamber and a second chamber, meanwhile, the bush unit contains: a first connection part used for connecting to the first chamber, meanwhile, the first connection part is complementary to the structure of one of the inner side walls of the first chamber; and a second connection part is used for connecting to a butt-joint part of the second chamber, wherein the first connection part and second connection part have different horizontal length dimensions.

【0011】 In one of the better embodiments of the present invention, horizontal length dimension of the first connection part is small than horizontal length dimension of the second connection part.

【0012】 In one of the better embodiments of the present invention, after the first connection part of the bush unit is associated with the first chamber, the second connection part of the bush unit will protrude out of a first end opening of the first chamber, meanwhile, the second connection part is accommodated within the second chamber.

【0013】 In one of the better embodiments of the present invention, horizontal length dimension of the first connection part is larger horizontal length dimension of the second connection part.

【0014】 In one of the better embodiments of the present invention, after the first connection part of the bush unit is associated with the first chamber, the butt-joint part of the second chamber will protrude into the bush unit and get

accommodated within the bush unit.

【0015】 In one of the better embodiments of the present invention, the plasma reaction device contains a third chamber, meanwhile, the bush unit further contains a third connection part, relative to the second connection part, the bush unit connects the second chamber and the third connection part is used to connect to one of the butt-joint parts of the third chamber.

【0016】 In one of the better embodiments of the present invention, the first connection part and the third connection part have different horizontal length dimensions.

【0017】 In one of the better embodiments of the present invention, for the first connection part and the second connection part, at least one of them contains ring structure or other geometrical structure.

【0018】 In one of the better embodiments of the present invention, the bush unit further contains a first bush and a second bush, wherein the first bush and the second bush contains respectively the first connection part that is used to connect to the first chamber and the second connection part that is used to connect to another chamber, meanwhile, the first connection part and second connection part of the first bush have different horizontal length dimensions, and the first connection part and second connection part of the second bush have different horizontal length dimensions.

【0019】 In one of the better embodiments of the present invention, the first bush and the second bush contain respectively structure-complementary third connection part, meanwhile, when the first bush and the second bush is associated respectively with the first chamber, those third connection parts of the first bush and the second bush will get mutually connected.

【0020】 In one of the better embodiments of the present invention, the bush unit further contains a plurality of bushes, wherein the plurality of bushes contain respectively the first connection part used to connect to the first chamber and the second connection part used to connect to another chamber, meanwhile,

the first connection part and the second connection part of the plurality of bushes have different horizontal length dimensions.

【0021】 In one of the better embodiments of the present invention, when the second connection part of the bush unit is abutted to the butt-joint part of the second chamber, an accommodation space is then formed between the second connection part and the second chamber to accommodate airtight device.

【0022】 In one of the better embodiments of the present invention, the second connection part of the bush unit forms a stair shape, which includes a first stair, a second stair and a third stair, when the second connection part of the bush unit is abutted to the butt-joint part of the second chamber, the butt-joint part of the second chamber will connect to one first horizontal stairs face of the first stair and one third horizontal stairs face of the third stair, meanwhile, it will form together with the second stair the accommodation space to accommodate the airtight device.

【0023】 This invention also provides a bush unit used in plasma reaction device, , and the plasma reaction device contains a first chamber and a plurality of second chambers, the bush unit contains: a first connection part used to be connected to the first chamber, meanwhile, the first connection part and one inner side wall of the first chamber is structurally complementary to each other; and a plurality of second connection parts used to be abutted respectively to one butt-joint part of the plurality of second chambers, wherein the first connection part and each of the second connection part have different horizontal length dimensions.

【Brief description of several views of the drawings】

【0024】

Figure 1 shows a traditional plasma reaction device.

Figure 2 shows exploded assembly drawing according to bush unit and plasma reaction device of the first embodiment of the present invention.

Figure 3 shows the partial assembly view drawing of figure 2.

Figure 4 shows the cross-section exploded drawing of bush unit and plasma reaction device of figure 2.

Figure 5 shows cross-section exploded drawing of bush unit and plasma reaction device according to the second embodiment of the present invention.

Figure 6 shows cross-section assembly view drawing of bush unit and plasma reaction device according to the third embodiment of the present invention.

Figure 7 shows assembly exploded drawing of bush unit and plasma reaction device according to the fourth embodiment of the present invention.

Figure 8 shows the cross-section exploded drawing of bush unit and plasma reaction device of figure 7.

Figure 9 shows cross-section exploded drawing of bush unit and plasma reaction device according to the fifth embodiment of the present invention.

Figure 10 shows cross-section assembly view drawing of figure 9.

Figure 11 shows cross-section exploded drawing of bush unit and plasma reaction device according to the sixth embodiment of the present invention.

Figure 12 shows partial amplified view drawing of bush unit according to the seventh embodiment of the present invention.

Figure 13 shows partial amplified view drawing of bush unit according to the eighth embodiment of the present invention.

【Detailed description of the embodiments of the invention】

【0025】 In order to let the above and other objectives, features and advantages of the present invention be obvious and easy to understand, in the following context, a better embodiment of the present invention will be proposed specifically, accompanied with the attached drawings, for the

following detailed descriptions.

【0026】 Please refer to figure 2, figure 3 and figure 4, which show a bush unit 110 used in plasma reaction device 100 according to the first embodiment of the present invention, wherein figure 2 shows an assembly exploded drawing of the bush unit 110 and the plasma reaction device 100, and figure 3 shows partial assembly view drawing of the bush unit 110 and the plasma reaction device 100 of figure 2, and figure 4 shows cross-section exploded drawing of the bush unit 110 and the plasma reaction device 100 of figure 2. The plasma reaction device 100 contains a first chamber 120 and a second chamber 130, and the bush unit 110 contains a first connection part 112 and a second connection part 114.

【0027】 As shown in figure 2 to figure 4, the first connection part 112 of the bush unit 110 is connected to the first chamber 120, meanwhile, the outer side wall of the first connection part 112 and an inner side wall 122 connecting to the first chamber 120 are structurally complementary. As shown in the first embodiment of the present invention, outer side wall of the first connection part 112 and inner side wall 122 of the first chamber 120 are all of ring structures. It can be understood that in other embodiment, the mutually associated outer side wall of first connection part and inner side wall of first chamber 120 can be of any geometrical structures that are structurally complementary.

【0028】 In another aspect, in order to let outer side wall of the first connection part 112 of the bush unit 110 and inner side wall 122 of the first chamber 120 be able to be associated closely, it can be achieved through, for example, the respective formation of structurally complementary screw on outer side wall of the first connection part 112 and the connecting face of the inner side wall 122 of the first chamber 120 so that both parts can be closely locked, or in another way, the joining face between both parts can be coated with ceramic heat dissipation paste or through the use of vacuum screw, however, it is not limited to this. In addition to this, any method that can create close

association between outer side wall of the first connection part 112 of the bush unit 110 and the inner side wall 122 of the first chamber 120 can also be applied to other embodiment of the present invention.

【0029】 As shown in figure 2 to figure 4, when the first connection part 112 of the bush unit 110, through a first end opening 124 of the first chamber 120, is installed into the first chamber 120 and is associated with the first chamber 120, it will make the second connection part 114 of the bush unit 110 protrude out of the first end opening 124 of the first chamber 120. Next, the bush unit 110 and the second chamber 130 are assembled. As shown in the figure, the second connection part 114 of the bush unit 110 is used to be abutted to a butt-joint part 132 of the second chamber 130.

【0030】 As shown in figure 2 to figure 4, horizontal length dimension C1 of the first connection part 112 of the bush unit 110 and horizontal length dimension C2 of the second connection part 114 are different. More specifically speaking, as shown in first embodiment of the present invention, horizontal length dimension C1 of the first connection part 112 is smaller than horizontal length dimension C2 of the second connection part 114, however, in other embodiment, horizontal length dimension C1 of the first connection part 112 can also be designed horizontal length dimension C2 of the second connection part114.

【0031】 Furthermore, before the association between the second connection part 114 of the bush unit 110 and the second chamber 130, it is better to put O-ring and/or ceramic ring and/or coat vacuum paste on the peripheral of outer side wall of the second connection part 114 so that after the first chamber 120 and the second chamber 130 are associated, it will have better air tightness. In addition to this, any method that can achieve better air tightness effect can also be applicable to other embodiments of this invention.

【0032】 Please refer to figure 5, which shows cross-section exploded drawing according to bush unit 210 and plasma reaction device 200 of the

second embodiment of the present invention. The plasma reaction device 200 contains a first chamber 130’ and a second chamber 230, and the bush unit 210 contains a first connection part 212 and a second connection part132’.

【0033】 As shown in figure 5, the first connection part 212 of the bush unit 210 is located at outer side wall of the bush unit 210, and the second connection part132’ of the bush unit 210 is located at inner side wall of the bush unit 210, wherein horizontal length dimension C1 of the first connection part 212 of the bush unit 210 and horizontal length dimension C2 of the second connection part132’ are different. More specifically speaking, horizontal length dimension C1 of the first connection part 212 is larger than horizontal length dimension C2 of the second connection part 132’.

【0034】 As shown in figure 5, the first connection part 212 of the bush unit 210 and inner side wall of the first chamber 130’ are mutually complementary in structure so that they can be associated to each other. Since the second connection part 132’ of the bush unit 210 is located at inner side wall of the bush unit 210, therefore, when the first connection part 212 of the bush unit 210 is associated with the first chamber 130’, one butt-joint part 232 of the second chamber 230 will protrude into the bush unit 210 and will be accommodated within the bush unit 210, wherein the butt-joint part 232 belongs to one part of outer side wall of the second chamber 230. Furthermore, as shown in figure, the second chamber 230 can be formed through mutual assembly of single chamber and one second bush unit 210’.

【0035】 In another aspect, single bush unit of this invention can also be associated with a plurality of plasma reaction devices. For example, in one better embodiment, plasma reaction device can contain one first chamber and a plurality of second chambers, and bush unit can contain one first connection part and a plurality of second connection parts, wherein the first connection part is used to be connected to the first chamber, meanwhile, the first connection part and one inner side wall of the first chamber are structurally complementary. In

addition, the plurality of second connection parts is used to be abutted respectively to one of the butt-joint parts of the plurality of second chambers. In order to describe more clearly the technical projects of the above embodiments, please refer to more specific description in the following third embodiment.

【0036】 Please refer to figure 6, which shows partial cross-section drawing of after-association of bush unit 310 and plasma reaction device 300 according to the third embodiment of the present invention. The plasma reaction device 300 contains one first chamber 320, one second chamber 330 and one third chamber 340, and the bush unit 310 contains one first connection part 312, one second connection part 314 and one third connection part 316. What should be noticed is, the second chamber 330 and the third chamber 340 of the present embodiment is similar to the above mentioned plurality of second chambers, and the second connection part 314 and third connection part 316 of the present invention are similar to the above mentioned plurality of second connection parts. Meanwhile, although the second chamber 330 and the third chamber 340 as shown in figure 6 has the same configuration and dimension, however, in other better embodiment, it can also contain a plurality of second chambers having different configurations and dimensions, meanwhile, corresponding plurality of second connection parts are also installed as having different configurations and dimensions.

【0037】 As shown in figure 6, the second connection part 314 of the bush unit 310 and the third connection part 316 are located respectively at relative two sides of the first connection part 312, meanwhile, the first connection part 312, the second connection part 314 and the third connection part 316 are all formed at outer side wall of the bush unit 310, and the first connection part 312 is used to be associated with one inner side wall 322 of the first chamber 320. Meanwhile, the bush unit 310, through the association of the second connection part 314 and one butt-joint part 332 of the second chamber 330 so that the bush unit 310 can connect through the second chamber 330, and

be associated with one butt-joint part 342 of the third chamber 340 through the third connection part 316. Furthermore, the butt-joint part 332 belongs to one part of inner side wall of the third chamber 340.

【0038】 As shown in figure 6, two relative outer side walls of the bush unit 310 are similarly designed as of male head configuration. That is, first, associating outer side wall of the first connection part 312 of the bush unit 310 with the inner side wall 322 of the first chamber 320 so that the second connection part 314 and the third connection part 316 of the bush unit 310 protrude respectively out of relative two end openings of the first chamber 320. What needs to be noticed is, in another embodiment, plasma process principle can be based, and the magnetic line of force direction generated by the operation of the plasma reaction device 300 can be followed to design one of the second connection part 314 and the third connection part 316 of the bush unit 310 similar to the present embodiment as female head configuration. Then, chamber connected directly to it is installed with one second bush unit having one end protruding out of the end opening of the chamber (as second chamber 230 of the second embodiment shown in figure 5). That is, one of the connection parts of the bush unit is installed at inner side wall of the bush unit and is used to accommodate butt-joint part of the directly connected chamber.

【0039】 As shown in figure 6, horizontal length dimension C1 of the first connection part 310 of the bush unit 310 is different than horizontal length dimension C2 of the second connection part 314 and the third connection part 316. More specifically speaking, horizontal length dimension C1 of the first connection part 310 is larger than horizontal length dimension C2 of the second connection part 314 and the third connection part 316. What needs to be noticed is, quantity shown in second chamber and third chamber in the third embodiment of the present invention is only used as example, furthermore, in accordance with the type and form of plasma reaction device, quantity of chamber connected to bush unit can be of plural number, and it is not used to

limit the present invention.

【0040】 Please refer to figure 7 and figure 8, figure 7 shows an assembly exploded drawing based on bush unit 410 and plasma reaction device 400 of the fourth embodiment of the present invention, and figure 8 shows the cross-section exploded drawing of plasma reaction device 400 of figure 7. The plasma reaction device 400 contains a first chamber 420 having an inner side wall 422, and the bush unit 410 contains a first connection part 412 and a second connection part 414, where in the first connection part 412 is used to be associated with the first chamber 420 and the second connection part 414 is used to be associated with a second chamber (not shown).

【0041】 As shown in figure 7 and figure 8, the inner side wall 422 of the first chamber 420 used to be associated with the first connection part 412 of the bush unit 410 forms long disk shape structure, which is different than the ring shape structure in the above mentioned embodiment. Meanwhile, dimension of maximal horizontal length C1 of the first connection part 412 is larger than dimension of horizontal length C2 of the second connection part 414 of the bush unit 410.

【0042】 Please refer to figure 9 and figure 10. Figure 9 shows cross-section exploded drawing of bush unit 510 and plasma reaction device 500 according to fifth embodiment of the present invention, and figure 10 shows the cross-section assembly view drawing of figure 9. The plasma reaction device 500 contains a first chamber 520 having an inner side wall 522, and the bush unit 510 contains a first bush 501 and a second bush 505, which are installed respectively at relative two ends of the first chamber 520, wherein the first bush 501 and the second bush 505 contain respectively a first connection part 512 and 512’ used to be connected to the first chamber 520 and the second connection part 514 and 514’ used to be connected to another chamber (not shown).

【0043】 As shown in figure 9 and figure 10, the first bush 501 and the second bush 505 of the bush unit 510 are all of irregular geometrical

configurations. The first bush 501 and the second bush 505 contain respectively structurally complementary third connection part 516 and 516', meanwhile, when the first bush 501 and the second bush 505 are associated respectively with upper and lower part of the first chamber 520, it will further make those third connection part 516 and 516' of the first bush 501 and the second bush 505 associated with each other. What needs to be noticed is, those third connection part 516 and 516' contain all kinds of structurally complementary configurations, for example, inverted hook shape, slanted angle shape or other similar shape, etc.

【0044】 As shown in figure 9 to figure 10, maximal horizontal length dimension of the first connection part 512 of the first bush 501 is defined as C1, horizontal length dimension of the second connection part 514 of the first bush 501 is defined as C2, and horizontal length dimension of the third connection part 516 of the first bush 501 is defined as C3, wherein C1, C2 and C3 are all of different dimensions. Similarly, horizontal length dimension C1' of the first connection part 512' of the second bush 505 is different respectively with horizontal length dimension C2' of the second connection part 514' and horizontal length dimension C3' of the third connection part 516'.

【0045】 Please refer to figure 11, which shows cross-section exploded drawing of bush unit 610 and plasma reaction device 60 of the sixth embodiment of the present invention. The plasma reaction device 600 contains a first chamber 620 having an inner side wall 622, and the bush unit 610 contains a first bush 602, a second bush 604 and a third bush 606, wherein the first bush 602 and the second bush 604 are installed at one end of the first chamber 620, and the third bush 606 is installed at relative another end of the first chamber 620. The first bush 602, the second bush 604 and the third bush 606 contain respectively first connection part 6022, 6042 and 6062 used to be connected to the first chamber 620, and second connection part 6024, 6044 and 6064 used to be connected to another chamber (not shown).

【0046】 As shown in figure 11, maximal horizontal length dimension of the first connection part 6022 of the first bush 602 is defined as C1, horizontal length dimension of the second connection part 6024 is defined as C2, and horizontal length dimension of the third connection part 6026 is defined as C3, wherein the dimension of C1 is different than the dimension of C2 and C3. Similarly, horizontal length dimension C1’ of the first connection part 6042 of the second bush 604 is different respectively with horizontal length dimension C2’ of the second connection part 6044 and horizontal length dimension C3’ of the third connection part 6046; and horizontal length dimension C1’’ of the first connection part 6062 of the second bush 606 is different respectively with horizontal length dimension C2’’ of the second connection part 6064 and horizontal length dimension C3’’ of the third connection part 6066.

【0047】 As shown in figure 11, the first bush 602, the second bush 604 and the third bush 606 contain respectively structurally complementary third connection parts 6026, 6046 and 6066, meanwhile, when the first bush 602, the second bush 604 and the third bush 606 are connected respectively with the upper and lower part of the first chamber 620, it will further make those third connection parts 6026, 6046, 6066 of the first bush 602, the second bush 604 and the third bush 606 get associated to each other.

【0048】 From the above embodiments, it can be seen that this invention, in addition to using one-piece type bush unit to be corresponded to more than one chambers, it can also use multi-piece type bush unit to be corresponded to single chamber. For example, according to the fifth embodiment of the present invention, the bush unit 510 contains first bush 501 and second bush 505, meanwhile, those bushes are associated respectively with the same first chamber 520, or, as in the three-piece type bush unit 610 of the sixth embodiment, however, it is not limited to this.

【0049】 Please refer to figure 12, which shows partially magnified drawing of bush unit 710 according to the seventh embodiment of the present

invention. In the present embodiment, the external shape of second connection part 714 of the bush unit 710 shows two-stairs type stairs shape, which contains a first horizontal stairs face 7142 and a second horizontal stairs face 7144. When the second connection part 714 of the bush unit 710 is abutted to a butt-joint part 732 of a second chamber 730, the butt-joint part 732 of the second chamber 730is connected to part of the first horizontal stairs face 7142 and the second horizontal stairs face 7144, meanwhile, a closed accommodation space is formed in between the second connection part 714 and the second chamber 730. The accommodation space can be used to accommodate an airtight device 750, for example, the airtight ring.

【0050】 Please refer to figure 13, which shows partially magnified drawing of bush unit 810 according to the eighth embodiment of the present invention. The external shape of the second connection part 814 of the bush unit 810 shows three-stairs stairs shape, which includes a first stairs having a first horizontal stairs face 8142, a second stairs having a second horizontal stairs face 8144 and a third stairs having a third horizontal stairs face 8146. When the second connection part 814 of the bush unit 810 is abutted to a butt-joint part 832 of a second chamber 830, the butt-joint part 832 of the second chamber 830 is connected to the first horizontal stairs face 8142 of the first stairs and the third horizontal stairs face 8146 of the third stairs of the bush unit810, meanwhile, the butt-joint part 832 of the second chamber 830 forms together with the second stairs an accommodation space to accommodate an airtight device 850. What needs to be notices is, in the present invention, through the setup of an airtight structure as in the configuration shown in the above mentioned figure 12 or figure 13, there is no need to set up an additional ceramic ring in the present invention to ensure the acquisition of good airtight effect in between the bush unit of first chamber and second chamber, therefore, the manufacturing cost is reduced. In addition, through the above mentioned setup, the issues such as air leak and plasma corrosion caused by thermal deformation and distortion of the

chamber can be avoided.

【0051】 Although the present invention has been disclosed as above through better embodiments, however, they are not to be used to limit the present invention, anyone with common knowledge in the technical field of the prevent invention, without deviating from the spirit and scope of the present invention, can make any change and modification, therefore, the protection scope of the present invention should be defined by the scope of "what is claimed" attached below.

【Description of element】

【0052】

10	plasma reaction device	11	first chamber
12	second chamber	13	third chamber
100	plasma reaction device	110	bush unit
112	first connection part	114	second connection part
120	first chamber	122	inner side wall
124	first end opening	130	second chamber
132	butt-joint part	200	plasma reaction device
210	bush unit	212	first connection part
132'	second connection part	130'	first chamber
230	second chamber	232	butt-joint part
210'	second bush unit	300	plasma reaction device
310	bush unit	312	first connection part
314	second connection part	316	third connection part
320	first chamber	322	inner side wall
330	second chamber	332	butt-joint part
340	third chamber	342	butt-joint part
400	plasma reaction device	410	bush unit
412	first connection part	414	second connection part
420	first chamber	422	inner side wall
500	plasma reaction device	510	bush unit
501	first bush	505	second bush
512, 512'	first connection part	514 , 514'	second connection part
516 , 516'	third connection part	520	first chamber
522	inner side wall	600	plasma reaction device
610	bush unit	602	first bush
604	second bush	606	third bush
6022, 6042, 6062	first connection part	6024, 6044, 6064	second

connection part

6026, 6046, 6066	third connection part	620	first chamber
622	inner side wall	700	plasma reaction device
710	bush unit	714	second connection part
7142	first horizontal stairs face	7144	second horizontal stairs face
730	second chamber	732	butt-joint part
750	airtight device	800	plasma reaction device
810	bush unit	814	second connection part
8142	first horizontal stairs face	8144	second horizontal stairs face
8146	third horizontal stairs face	830	second chamber
832	butt-joint part	850	airtight device
C1, C2, C3, C1', C2', C3', C1'', C2'', C3''	horizontal length dimension		

What is claimed is

1. A bush unit used in plasma reaction device, and the plasma reaction device contains a first chamber and a second chamber, and the bush unit contains:

   a first connection part, which is used to be connected to the first chamber, meanwhile, an inner wall of the first connection part and an inner wall of the first chamber are structurally complementary; and

   a second connection part, which is used to be abutted to a butt-joint part of the second chamber, wherein horizontal length dimensions of the first connection part and the second connection part are different.
2. The bush unit of claim 1 wherein horizontal length dimension of the first connection part is smaller than horizontal length dimension of the second connection part.
3. The bush unit of claim 1 wherein when the first connection part of the bush unit is associated with the first chamber, the second connection part of the bush unit protrudes out of a first end opening of the first chamber, meanwhile, the second connection part is accommodated within the second chamber.
4. The bush unit of claim 1 wherein horizontal length dimension of the first connection part is larger than horizontal length dimension of the second connection part.
5. The bush unit of claim 1 wherein when the first connection part of the bush unit is associated with the first chamber, the butt-joint part of the second chamber protrudes into the bush unit, meanwhile, it will be accommodated within the bush unit.
6. The bush unit of claim 1 wherein the plasma reaction device contains a third chamber, meanwhile, the bush unit further includes a third connection part, relative to the second connection part, the bush unit connects through the second chamber, and the third connection part is used to be connected to one of the butt-joint parts of the third chamber.

7. The bush unit of claim 6 wherein horizontal length dimensions of the first connection part and the third connection part are different.
8. The bush unit of claim 1 wherein at least one of the first connection part and the second connection part contains ring structure or other geometrical structure.
9. The bush unit of claim 1 wherein it further includes a first bush and a second bush, wherein the first bush and the second bush contain respectively the first connection part used to be connected to the first chamber and the second connection part used to be connected to another chamber, meanwhile, horizontal length dimensions of the first connection part and the second connection part of the first bush are different, and horizontal length dimensions of the first connection part and the second connection part of the second bush are different.
10. The bush unit of claim 9 wherein the first bush and the second bush contain respectively structurally complementary third connection part, meanwhile, when the first bush and the second bush are associated respectively with the first chamber, those third connection parts of the first bush and the second bush associate with each other.
11. The bush unit of claim 1 wherein it further includes a plurality of bushes, wherein those plurality of bushes contain respectively the first connection part used to be connected to the first chamber and the second connection part used to be connected to another chamber, meanwhile, horizontal length dimensions of the first connection part and the second connection part of those plurality of bushes are different.
12. The bush unit of claim 1 wherein when the second connection part of the bush unit is abutted to the butt-joint part of the second chamber, an accommodation space is formed in between the second connection part and the second chamber to accommodate an airtight device.
13. The bush unit of claim 12 wherein the second connection part of the bush

unit forms a stairs shape, which include a first stairs, a second stairs and a third stairs, when the second connection part of the bush unit is abutted to the butt-joint part of the second chamber, the butt-joint part of the second chamber is connected to a first horizontal stairs face of the first stairs and a third horizontal stairs face of the third stairs, meanwhile, it forms together with the second stairs the accommodation space to accommodate the airtight device.

14. A bush unit used in plasma reaction device, and the plasma reaction device contains a first chamber and a plurality of second chamber, and the bush unit contains:

a first connection part, which is used to be connected to the first chamber, meanwhile, the first connection part is structurally complementary to one inner side wall of the first chamber; and

a plurality of second connection parts, which are used respectively to be abutted to one of butt-joint parts of those plurality of second chambers, wherein horizontal length dimensions of the first connection part and each of the second connection part are different.