

This application claims priority under 35 USC § 119 to Korean Patent Application No. 2007-107927, filed on October 25, 2007 in the Korean Intellectual Property Office (KIPO), the contents of which are herein incorporated by reference in entirety.

## 1. Field of the Invention

Example embodiments of the present invention relate to a connection member, a ground structure, a heater and an apparatus for processing a substrate including the connection member. More particularly, example embodiments of the present invention relate to a connection member for connecting a ground terminal to a ground mount, a ground structure, a heater and an apparatus for processing a substrate including the connection member.

Generally, a semiconductor device may be manufactured by a fab process for forming electrical circuits on a semiconductor substrate, an electrical die sorting (ESD) process for testing electrical characteristics of the semiconductor device, and a packaging process for encapsulating the semiconductor device with an epoxy resin, and singulating the semiconductor substrate into semiconductor chips.

The fab process may include a deposition process for forming a layer on the semiconductor substrate, a chemical mechanical polishing (CMP) process for

planarizing the layer, a photolithography process for forming a photoresist pattern on the layer, an etching process for forming a pattern having electrical characteristics from the layer, an ion implantation process for implanting impurities into the semiconductor substrate, a cleaning process for removing foreign substances on the semiconductor substrate, a drying process for drying the cleaned semiconductor substrate, and a test process for detecting defects in the layer or the pattern.

Nowadays, a plasma-enhanced chemical vapor deposition (PECVD) apparatus, which may excite a process gas into a plasma state to form the layer or the pattern, may be widely used in the fab process. The conventional PECVD apparatus may include a process chamber having a space where a semiconductor substrate is processed, a heater in the process chamber to heat the semiconductor substrate, and an electrode for forming a plasma gas from a reaction gas introduced into the process chamber. The heater may include a heating block, a heating electrode built into the heating block, and a ground structure built into the heating block. An example of the ground structure is disclosed in Korean Utility Model Registration No. 0420693.

FIG. 1 is a perspective view illustrating a conventional ground structure, and FIG. 2 is a perspective view illustrating a conductive sheet and a clamp of the ground structure in FIG. 1.

Referring to FIGS. 1 and 2, a ground structure 1 includes a clamp for clamping a ground terminal 20, and a conductive sheet 40 connected between the clamp 30 and a ground base 10 to form a ground path. The clamp 30 and the conductive sheet 40, and the conductive sheet 40 and the ground base 10 are fixed to each other, respectively, using screws 50.

However, since the clamp 30, the conductive sheet 40 and the ground base 10 are assembled with one another using the screws 50, contact failures may be

generated between the clamp 30 and the conductive sheet 40, and the conductive sheet 40 and the ground base 10. Thus, arcing may be generated between the clamp 30 and the conductive sheet 40, and the conductive sheet 40 and the ground base 10.

5 Further, since the conductive sheet 40 has a U-shape, high-frequency power for converting a process gas into plasma may be concentrated on a bent portion of the conductive sheet 40. Therefore, the concentrated high-frequency power may cut the bent portion of the conductive sheet 40.

## 10 SUMMARY OF THE INVENTION

Example embodiments of the present invention provide a connection member that is capable of stably connecting a ground terminal to a ground mount.

Example embodiments of the present invention also provide a ground structure including the above-mentioned connection member.

15 Example embodiments of the present invention still also provide a heater including the above-mentioned connection member.

Example embodiments of the present invention still yet also provide an apparatus for processing a substrate including the above-mentioned connection member.

20 A connection member in accordance with one aspect of the present invention includes a clamping portion, a fixing portion and a bending portion. The clamping portions holds a ground terminal. The fixing portion is fixed to a ground mount. The bending portion is connected between the clamping portion and the fixing portion. The bending portion is bent for allowing the clamping portion to move along a  
25 lengthwise direction of the ground terminal.

According to one example embodiment, the clamping portion, the fixing portion and the bending portion may be integrally formed with one another.

According to another example embodiment, the clamping portion, the fixing portion and the bending portion may include substantially the same conductive material.

According to still another example embodiment, the clamping portion, the fixing portion and the bending portion may have uneven portions formed at surface portions of the clamping portion, the fixing portion and the bending portion.

According to still yet another example embodiment, the bending portion may have a flat plate shape through which a plurality of holes is formed.

Further, the bending portion may have a thickness of about 1 mm to about 3 mm.

Furthermore, the bending portion may have an uneven surface.

According to still yet another example embodiment, connection portions between the bending portion and the fixing portion, and the bending portion and the clamping portion may be a rounded shape.

Further, the rounded connection portions may have a radius of about 0.5 mm to about 3 mm.

According to still yet another example embodiment, the clamping portion may include two flat plates, and a curved plate connected between the flat plates to form a receiving hole for receiving the ground terminal.

Further, the connection member may include a screw inserted into the plates to fix the ground terminal in the receiving hole.

A ground structure in accordance with another aspect of the present invention includes a ground mount, a ground terminal, and a connection member. The ground

terminal is movably inserted into the ground mount. The connection member electrically connects the conductive holder to the ground mount. Further, the connection member is bent along a lengthwise direction of the ground terminal in accordance with thermal expansion of the ground terminal.

5           According to one example embodiment, the connection member may include a clamping portion for holding the ground terminal, a fixing portion fixed to a ground mount, and a bending portion connected between the clamping portion and the fixing portion. The bending portion is bent for allowing the clamping portion to move along a lengthwise direction of the ground terminal.

10           According to one example embodiment, the ground mount may further include an insulation member interposed between the ground mount and the clamping portion.

          According to another example embodiment, the ground mount may have a receiving space for receiving the connection member. Further, the receiving space may be covered with an insulation cover.

15           A ground structure in accordance with still another aspect of the present invention includes a ground mount, a ground terminal, a connection member and an insulation member. The ground mount has a receiving space. The ground terminal is movably inserted into the ground mount and is exposed through the receiving space. The connection member electrically connects the ground terminal to the ground mount.

20           The connection member includes a clamping portion for resiliently holding the ground terminal, a fixing portion fixed to a side face of the receiving space, and a bending portion connected between the clamping portion and the fixing portion. The clamping portion has a flat plate shape through which a plurality of holes is formed. The bending portion is bent for allowing the clamping portion to move along a lengthwise

25           direction of the ground terminal. The insulation member is interposed between the

ground mount and the clamping portion.

According to one example embodiment, the ground structure may further include an insulation cover for covering the receiving space.

According to another example embodiment, the clamping portion, the fixing  
5 portion and the bending portion may be integrally formed with one another.

According to still another example embodiment, connection portions between the bending portion and the fixing portion, and the bending portion and the clamping portion may be a rounded shape.

A heater in accordance with still another aspect of the present invention  
10 includes a heating block, a heating element, an electrode, a ground mount, a ground terminal, and a connection member. The heating element is built into the heating block. The electrode is built into the heating block. The ground mount is mounted on the heating block. The ground terminal is movably inserted into the ground mount. Further, the ground terminal is electrically connected to the electrode. The  
15 connection member electrically connects the conductive holder to the ground mount. Further, the connection member is bent along a lengthwise direction of the ground terminal in accordance with thermal expansion of the ground terminal.

An apparatus for processing a substrate in accordance with still yet another aspect of the present invention includes a chamber, a heater, a reaction gas-providing  
20 member, and an upper electrode. The chamber receives the substrate. The heater is arranged at a lower space of the chamber to heat the substrate. The reaction gas-providing member is located at an upper space of the chamber to provide a reaction gas onto the substrate. The upper electrode is arranged in the chamber to form plasma from the reaction gas. The heater includes a heating block, a heating  
25 element, a lower electrode, a ground mount, a ground terminal, and a connection

member. The heating element is built into the heating block. The lower electrode is built into the heating block. The ground mount is mounted on the heating block. The ground terminal is movably inserted into the ground mount. Further, the ground terminal is electrically connected to the lower electrode. The connection member electrically connects the conductive holder to the ground mount. Further, the connection member is bent along a lengthwise direction of the ground terminal in accordance with thermal expansion of the ground terminal.

According to the present invention, a connection member may have one body to electrically connect a ground terminal to a ground mount. Thus, since contact failures between portions of the connection member may not be generated, arcing may not be generated.

Further, connection portions between a bending portion and a fixing portion, and the bending portion and a clamping portion may have a rounded shape. Thus, although high-frequency power may be concentrated on the connection portions, the bending portion may not be cut.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the invention will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view illustrating a conventional ground structure;

FIG. 2 is a perspective view illustrating a clamp and a conductive sheet of the ground structure in FIG. 1;

FIG. 3 is a perspective view illustrating a ground structure in accordance with an example embodiment of the present invention;

FIG. 4 is a perspective view illustrating a connection member of the ground structure in FIG. 3;

FIGS. 5 to 7 are perspective views illustrating connection members in accordance with other example embodiments of the present invention;

FIG. 8 is a cross-sectional view illustrating a heater in accordance with an example embodiment of the present invention; and

FIG. 9 is a cross-sectional view illustrating an apparatus for processing a substrate in accordance with an example embodiment of the present invention.

## 10 DESCRIPTION OF THE EMBODIMENTS

The present invention is described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these 15 embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

It will be understood that when an element or layer is referred to as being "on," "connected to" or "coupled to" another element or layer, it can be directly on, connected or coupled to the other element or layer or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly connected to" or "directly coupled to" another element or layer, there are no intervening elements or layers present. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

Spatially relative terms, such as "beneath," "below," "lower," "above," "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the exemplary term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes" and/or "including," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components,

but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

#### Ground Structure

FIG. 3 is a perspective view illustrating a ground structure in accordance with an example embodiment of the present invention.

Referring to FIG. 3, a ground structure 100 of this example embodiment includes a ground mount 110, a ground terminal 120, a connection member 130, an insulation member 140 and a cover 150.

The ground mount 110 may have a cylindrical shape. In this example embodiment, the ground mount 110 may include a conductive material such as aluminum. The ground mount 110 has a receiving space 112 and a first hole 114.

The receiving space 112 is formed at a side face of the ground mount 110. The receiving space 112 is exposed through an upper face of the ground mount 110. In this example embodiment, the receiving space 112 may have a quarter-circular cross-section. Further, a second hole (not shown) connected to the receiving space 112 may be vertically formed through the ground mount 110.

The first hole 114 is vertically formed through the ground mount 110. A

heating element (not shown) of a heater (not shown) and a cable (not shown) for supplying a current to an electrode (not shown) are received in the first hole 114.

The ground terminal 120 is inserted into the second hole. The ground terminal 120 in the second hole is protruded into the receiving space 112. In this example embodiment, the ground terminal 120 may have a diameter shorter than that of the second hole. Thus, the ground terminal 120 is placed movably in a vertical direction through the second hole. The ground terminal 120 may include nickel. Further, the ground terminal 120 may be connected to the electrode (not shown) of the heater by a brazing process.

The connection member 130 is placed in the receiving space 112. The connection member 130 electrically connects the ground mount 110 to the ground terminal 120.

FIG. 4 is a perspective view illustrating a connection member of the ground structure in FIG. 3.

Referring to FIGS. 3 and 4, the connection member 130 includes a clamping portion 132, a fixing portion 134, a bending portion 136, a first screw 138 and a second screw 139.

The clamping portion 132 is positioned in the receiving space 112. The clamping portion 132 may have a resilient plate having a thin thickness. The clamping portion 132 may have a U-shape of which a middle portion is bent. In this example embodiment, the clamping portion 132 includes two vertical plates 132a and 132b, and a curved plate 132c. The two vertical plates 132a and 132b have first screw holes 132e, respectively. The curved plate 132c is connected between sides of the vertical plates 132a and 132b to connect the vertical plates 132a and 132b to each other. The curved plate 132c forms a receiving hole 132d for receiving the

ground terminal 120. Thus, the receiving hole 132d may have a diameter substantially the same as that of the ground terminal 120. As a result, the clamping portion 132 surrounds an outer face of the ground terminal received in the receiving hole 132d.

5           The first screw 138 fixes the two vertical plates 132a and 132b through the first screw hole 132e. Thus, the clamping portion 132 secures the ground terminal 120. Further, an inner face of the clamping portion 132 closely makes contact with the outer face of the ground terminal 120.

10           Here, since the ground terminal 120 has an upper diameter greater than the diameter of the receiving hole 132d of the clamping portion 132, the ground terminal 120 may not be released from the clamping portion 132 without unfastening the first screw 138.

15           The fixing portion 134 is arranged in the receiving space 112. The fixing portion 134 makes contact with the ground mount 110. Here, since the fixing portion 134 has a vertical flat plate shape, a contact area between the fixing portion 134 and the ground mount 110 becomes enlarged. Further, the fixing portion 134 has a second screw hole 134a.

20           The second screw 139 secures the fixing portion 134 and the ground mount 110 to each other through the second screw hole 134a. Thus, the fixing portion 134 closely makes contact with the ground mount 110.

25           The bending portion 136 is connected between the clamping portion 132 and the fixing portion 134. In this example embodiment, the bending portion 137 may connect any one of upper ends of the two vertical plates 132a and 132b in the clamping portion 132 to an upper end of the fixing portion 134. For example, the bending portion 136 may have a flat plate shape through which a plurality of third

holes 136a is formed. Further, the third holes 136a may have various shapes such as a tetragonal shape, a circular shape, an elliptical shape, etc. Here, since the bending portion 136 has the third holes 136a, the bending portion 136 may be readily bent. Alternatively, the bending portion 136 may have a flat plate shape without holes.

5 In this example embodiment, the bending portion 136 may have a thickness of about 1 mm to about 3 mm. The thickness of the bending portion 136 may provide the bending portion 136 with durability when high-frequency power for converting a reaction gas into plasma is applied to the bending portion 136. Further, the bending portion 136 is bent for allowing the clamping portion 132 holding the ground terminal  
10 120 to move along a lengthwise direction of the ground terminal 120 in accordance with thermal expansion of the ground terminal 120. Furthermore, as mentioned above, since the clamping portion 132 is moved in the vertical direction, the thermal expansion of the ground terminal 120 caused by a high temperature of the heater may not be restricted. As a result, the ground terminal 120 brazed to the heater may not  
15 be cut.

Here, when the thickness of the bending portion 136 is below about 1 mm, the bending portion 136 may crack due to the high-frequency power. In contrast, when the thickness of the bending portion 136 is above about 3 mm, the bending portion 136 may not be readily bent.

20 Further, connection portions between the bending portion 136 and the fixing portion 134 and between the bending portion 136 and the clamping portion 132 may have a rounded shape. Here, the high-frequency power may be concentrated on the connection portions. Thus, the rounded connection portions may have thick thickness for allowing the connection portions to endure the high-frequency power.

25 In this example embodiment, the rounded connection portions may have a radius R of

about 0.5 mm to about 3 mm.

Here, when the radius  $R$  is below about 0.5 mm, the connection portions may crack due to the high-frequency power. In contrast, when the radius  $R$  is above about 3 mm, the bending portion 136 may not be readily bent because the connection  
5 portions are too thick.

In this example embodiment, the clamping portion 132, the fixing portion 134 and the bending portion 136 may have uneven surfaces. The uneven surfaces of the clamping portion 132, the fixing portion 134 and the bending portion 136 may function to increase the surface area of the connection member 130.

10 The high-frequency power is transmitted through a surface of the connection member 130. A transmission path of the high-frequency power becomes enlarged in proportion to increasing the surface area of the connection member 130. Thus, the high-frequency power may be dispersively transmitted so that the connection member 130 may not be damaged, thereby extending the life span of the connection member  
15 130. The uneven surface of the connection member 130 may be formed by a bead blasting process, a sandblasting process, a chemical etching process, etc.

Alternatively, the high-frequency power may be transmitted through the bending portion 136. Thus, the uneven portion may be formed only at a surface of the bending portion 136. As a result, the high-frequency power may be dispersively  
20 transmitted so that the bending portion 136 may not be damaged, thereby extending the life span of the connection member 130.

Further, the clamping portion 132, the fixing portion 134 and the bending portion 136 may be integrally formed with one another. Thus, contact failures may not be generated between the clamping portion 132 and the bending portion 136 and  
25 between the fixing portion 134 and the bending portion 136 so that arcing may not

occur.

In this example embodiment, the clamping portion 132, the fixing portion and the bending portion 136 may include substantially the same conductive material. Examples of the conductive material may include beryllium (Be), copper (Cu), an alloy thereof, etc.

FIGS. 5 to 7 are perspective views illustrating connection members in accordance with other example embodiments of the present invention.

Connection members 130 in FIGS. 5 to 7 includes elements substantially the same as those of the connection member 130 in FIG. 3 except for a connection portion of a bending portion. Thus, the same reference numerals refer to the same elements and any further illustrations with respect to the same elements are omitted herein for brevity.

Referring to FIG. 5, the bending portion 136 connects any one of lower ends of the two plates 132a and 132b in the clamping portion 132 to a lower end of the fixing portion 134.

Referring to FIG. 6, the bending portion 136 connects any one of front ends of the two plates 132a and 132b in the clamping portion 132 to a front end of the fixing portion 134.

Referring to FIG. 7, the bending portion 136 connects any one of middle ends of the two plates 132a and 132b in the clamping portion 132 to a middle end of the fixing portion 134.

Referring again to FIGS. 3 and 4, the insulation member 140 is interposed between the ground mount 110 and the clamping portion 132 of the connection member 130 to electrically insulate the ground mount 110 from the clamping portion 132. The insulation member 140 includes a first insulator 142 and a second insulator

144.

The first insulator 142 is arranged between a side face of the ground mount 110 and the clamping portion 132, i.e., on a side face of the receiving space 112. The second insulator 144 is arranged between a bottom face of the ground mount 110 and the clamping portion 132, i.e., on a bottom face of the receiving space 112.

The cover 150 covers the receiving space 112. The cover 150 prevents the ground terminal 120 and the connection member 130 from being exposed to the outside. In this example embodiment, the cover 150 may include an insulation material. Thus, arcing may not occur between the ground terminal 120 and the cover 150, and between the connection member 130 and the cover 150.

According to this example embodiment, the first screw 138 fixes the clamping portion 132 so that the clamping portion 132 closely makes contact with the ground terminal 120. Thus, the arcing may not be generated between the ground terminal 120 and the connection member 130. Further, since the clamping portion 132, the fixing portion 134 and the bending portion 136 are integrally formed with one another, the arcing caused by the contact failures between the clamping portion 132 and the bending portion 136, and between the fixing portion 134 and the bending portion 136 may not occur.

Furthermore, the clamping portion 132 may be readily moved along the vertical direction due to the bending portion 136 so that the thermal expansion of the ground terminal 120 may not be restricted. Thus, the ground terminal 120 may not be cut.

Moreover, the connection portions between the clamping portion 132 and the bending portion 136, and between the fixing portion 134 and the bending portion 136 may have the rounded shape. Thus, although the high-frequency power may be concentrated on the connection portions, the bending portion 136 may not be cut.

### Heater

FIG. 8 is a cross-sectional view illustrating a heater in accordance with an example embodiment of the present invention.

5 Referring to FIG. 8, a heater 200 of this example embodiment includes a heating block 210, a heating element 220, an electrode 230 and the ground structure 100.

The heating block 210 includes a circular plate on which a semiconductor substrate is placed, and a vertical shaft connected to a lower central portion of the  
10 circular plate. In this example embodiment, the heating block 210 may include ceramic. Examples of the ceramic may include  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3/\text{Y}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{AlC}$ ,  $\text{TiN}$ ,  $\text{AlN}$ ,  $\text{TiC}$ ,  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{CeO}_2$ ,  $\text{TiO}_2$ ,  $\text{BxCy}$ ,  $\text{BN}$ ,  $\text{SiO}_2$ ,  $\text{SiC}$ ,  $\text{YAG}$ ,  $\text{Mullite}$ ,  $\text{AlF}_3$ , etc. These can be used alone or in a combination thereof.

The heating element 220 is built into the heating block 210. In this example  
15 embodiment, the heating element 220 may be arranged in a concentric circular pattern in the circular plate of the heating block 210. The heating block 220 generates heat for heating the semiconductor substrate. The heating block 220 may include a metal. Examples of the metal may include tungsten (W), molybdenum (Mo), tantalum (Ta), titanium (Ti), an alloy thereof, an iron-chromium (Fe-Cr) alloy, a nickel-chromium (Ni-  
20 Cr) alloy, etc.

The electrode 230 is built into the heating block 210. For example, the electrode 230 may be connected to a high-frequency power supply. Thus, the electrode 230 may induce plasma for processing the semiconductor substrate to the semiconductor substrate. Alternatively, the electrode 230 may be coupled to a direct  
25 current (DC) power supply. Thus, the electrode 230 may generate static electricity for

holding the semiconductor substrate.

The ground structure 100 includes a ground mount, a ground terminal, a connection member and a cover. Here, the ground structure 100 is substantially the same as the ground structure in FIGS. 3 to 7. Thus, any further illustrations with  
5 respect to the ground structure are omitted herein for brevity.

The ground mount of the ground structure 100 is mounted to a lower end of the vertical shaft of the heating block 210. The ground terminal of the ground structure 100 is electrically connected to the electrode 230.

#### Apparatus for Processing a Substrate

FIG. 9 is a cross-sectional view illustrating an apparatus for processing a substrate in accordance with an example embodiment of the present invention.

Referring to FIG. 9, an apparatus 300 of this example embodiment includes a chamber 310, a gas-providing member 320, a showerhead 330, an upper electrode  
15 340 and the heater 200.

The chamber 310 has a space where a semiconductor substrate is loaded and processed.

The gas-providing member 320 is connected to an upper face of the chamber 310. The gas-providing member 320 provides a reaction gas for processing the  
20 semiconductor substrate into the chamber 310.

The showerhead 330 is arranged at an upper space in the chamber 310. The showerhead 330 uniformly supplies the reaction gas to the semiconductor substrate.

The upper electrode 340 is connected to the showerhead 330. The upper electrode 340 applies a high voltage to the reaction gas to convert the reaction gas  
25 into plasma.

The heater 200 includes a heating block, a heating element, a lower electrode and a ground structure. Here, the heater 200 is substantially the same as the heater in FIG. 8. Thus, any further illustrations with respect to the heater 200 are omitted herein for brevity.

5 The heater 200 is arranged at a lower space of the chamber 310. The semiconductor substrate is placed on the heating block of the heater 200.

Evaluating connection member in accordance with thickness of bending portion

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Table 1

| Thickness of Bending<br>Portion (mm) | High-Frequency Power (W) |      |       |       |       |       |       |
|--------------------------------------|--------------------------|------|-------|-------|-------|-------|-------|
|                                      | 200                      | 500  | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 |
| 0.5                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 1.0                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 1.5                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 2.0                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 2.5                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 3.0                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Pass  | Pass  |
| 3.5                                  | Pass                     | Pass | Pass  | Pass  | Pass  | Fail  | -     |
| 4.0                                  | Pass                     | Pass | Pass  | Fail  | -     | -     | -     |

As shown in Table 1, high-frequency power levels of 200 W, 500 W, 1,000 W, 1,500 W, 2,000 W, 2,500 W and 3,000 W were applied to an electrode with the thickness of a bending portion being changed. When a high-frequency power level of no less than 3,000 W was applied to the electrode with the bending portion having the

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### Table 2

[illegible]

|     |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|
| 3.0 | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| 3.5 | Pass | Pass | Pass | Pass | Pass | Pass | Fail |
| 4.0 | Pass | Pass | Pass | Pass | Pass | Pass | Fail |

As shown in Table 2, high-frequency power levels of 200 W, 500 W, 1,000 W, 1,500 W, 2,000 W, 2,500 W and 3,000 W were applied to an electrode with the radius of a rounded connection portion being changed. Here, a bending portion had a thickness of 2 mm to 2.5 mm. When a high-frequency power level of no less than 1,500 W was applied to the connection portion with the radius of the connection portion being 0 mm, i.e., the connection portions not having a rounded shape, the high-frequency power was concentrated on the connection portion so that the bending portion was cut. When a high-frequency power level of no less than 3,000 W was applied to the connection portion with the radius of the connection portion being 3.0 mm or 4.0 mm, the bending portion was not bent when a ground terminal thermally expanded so that the ground terminal was bent.

As a result, it can be noted that the radius of the connection portion is advantageously about 0.5 mm to about 3 mm. The connection portion having the above-mentioned radius may prevent damage to the bending portion due to the high-frequency power. Further, the bending portion may be easily bent so that the ground terminal may not be damaged.

According to the present invention, arcing may not be generated at a connection member for connecting a ground terminal to a ground mount so that the connection member may not be damaged. Therefore, a ground structure, a heater and an apparatus for processing a substrate including the connection member may not be damaged to have a long life span.

Having described the preferred embodiments of the present invention, it is

noted that modifications and variations can be made by persons skilled in the art in light of the above teachings. It is therefore to be understood that changes may be made in the particular embodiment of the present invention disclosed which is within the scope and the spirit of the invention outlined by the appended claims.

## WHAT IS CLAIMED IS:

1. A connection member of a ground structure, comprising:  
a clamping portion for holding a ground terminal of the ground structure;  
5 a fixing portion fixed to a ground mount of the ground structure; and  
a bending portion connected between the clamping portion and the fixing  
portion, the bending portion being bent for allowing the clamping portion to move  
along a lengthwise direction of the ground terminal.

10 2. The connection member of claim 1, wherein the clamping portion, the  
fixing portion and the bending portion are integrally formed with one another.

3. The connection member of claim 1, wherein the clamping portion, the  
fixing portion and the bending portion comprise substantially the same conductive  
15 material.

4. The connection member of claim 1, wherein the clamping portion, the  
fixing portion and the bending portion have uneven surfaces, respectively.

20 5. The connection member of claim 1, wherein the bending portion has a  
flat plate shape through which a plurality of holes is formed.

6. The connection member of claim 1, wherein the bending portion has a  
thickness of about 1 mm to about 3 mm.

7. The connection member of claim 1, wherein the bending portion has an uneven surface.

8. The connection member of claim 1, wherein connection portions between the bending portion and the clamping portion, between the bending portion and the fixing portion have a rounded shape.

9. The connection member of claim 8, wherein the rounded connection portions have a radius of about 0.5 mm to about 3 mm.

10. The connection member of claim 1, wherein the clamping portion comprises:

two flat plates; and

a curved plate connected between the flat plates to form a receiving hole for receiving the ground terminal.

11. The connection member of claim 10 wherein the clamping portion further comprises a screw inserted into the flat plates to fix the ground terminal.

12. A ground structure comprising:  
a ground mount;  
a ground terminal movably inserted into the ground mount; and  
a connection member for holding the ground terminal to electrically connect the ground terminal to the ground mount, the connection member being bent along a lengthwise direction of the ground terminal in accordance with a thermal expansion of

the ground terminal.

13. The ground structure of claim 12, wherein the connection member comprises:

- 5           a clamping portion for holding the ground terminal;  
          a fixing portion fixed to the ground mount; and  
          a bending portion connected between the clamping portion and the fixing portion, the bending portion being bent for allowing the clamping portion to move along a lengthwise direction of the ground terminal.

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14. The ground structure of claim 13, wherein the connection member further comprises an insulation member interposed between the ground mount and the clamping portion.

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15. The ground structure of claim 12, wherein the ground mount has a receiving space for receiving the connection member.

16. The ground structure of claim 15, further comprising an insulation cover for covering the receiving space.

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17. A ground structure comprising:  
a ground mount having a receiving space;  
a ground terminal movably inserted into the ground mount and exposed through the receiving space;

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a connection member electrically connected between the ground terminal and

the ground mount, the connection member including a clamping portion for resiliently holding the ground terminal, a fixing portion fixed to a side face of the receiving space, and a bending portion connected between the clamping portion and the fixing portion, the bending portion being bent for allowing the clamping portion to move along a lengthwise direction of the ground terminal; and

an insulation member interposed between the ground mount and the clamping portion.

18. The ground structure of claim 17, further comprising an insulation cover for covering the receiving space.

19. The ground structure of claim 17, wherein the clamping portion, the fixing portion and the bending portion are integrally formed with one another.

20. The ground structure of claim 17, wherein connection portions between the bending portion and the clamping portion, between the bending portion and the fixing portion have a rounded shape.

21. A heater comprising:

a heating block;

a heating element built into the heating block;

an electrode built into the heating block;

a ground mount mounted on the heating block;

a ground terminal movably inserted into the ground mount and connected to the electrode; and

a connection member for holding the ground terminal to connect the ground terminal to the ground mount, the connection member being bent along a lengthwise direction of the ground terminal in accordance with a thermal expansion of the ground terminal.

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22. An apparatus for processing a substrate, comprising:

a chamber for receiving the substrate;

a heater arranged in a lower space of the chamber to heat the substrate;

a gas-providing member arranged in an upper space of the chamber to

10 providing a reaction gas to the substrate; and

an upper electrode provided in the chamber to form plasma from the reaction gas,

wherein the heater comprises a heating block, a heating element built into the heating block, an electrode built into the heating block, a ground mount mounted on  
15 the heating block, a ground terminal movably inserted into the ground mount and connected to the electrode, and a connection member for holding the ground terminal to connect the ground terminal to the ground mount, the connection member being bent along a lengthwise direction of the ground terminal in accordance with a thermal expansion of the ground terminal.