US 20120318455A1

(19) **United States**

(12) **Patent Application Publication**

Fischer et al.

(10) **Pub. No.: US 2012/0318455 A1**

(43) **Pub. Date: Dec. 20, 2012**

(54) **PASSIVE COMPENSATION FOR TEMPERATURE-DEPENDENT WAFER GAP CHANGES IN PLASMA PROCESSING SYSTEMS**

(76) Inventors: **Andreas Fischer**, Castro Valley, CA (US); **Gregory Sexton**, Fremont, CA (US)

(21) Appl. No.: **13/160,452**

(22) Filed: **Jun. 14, 2011**

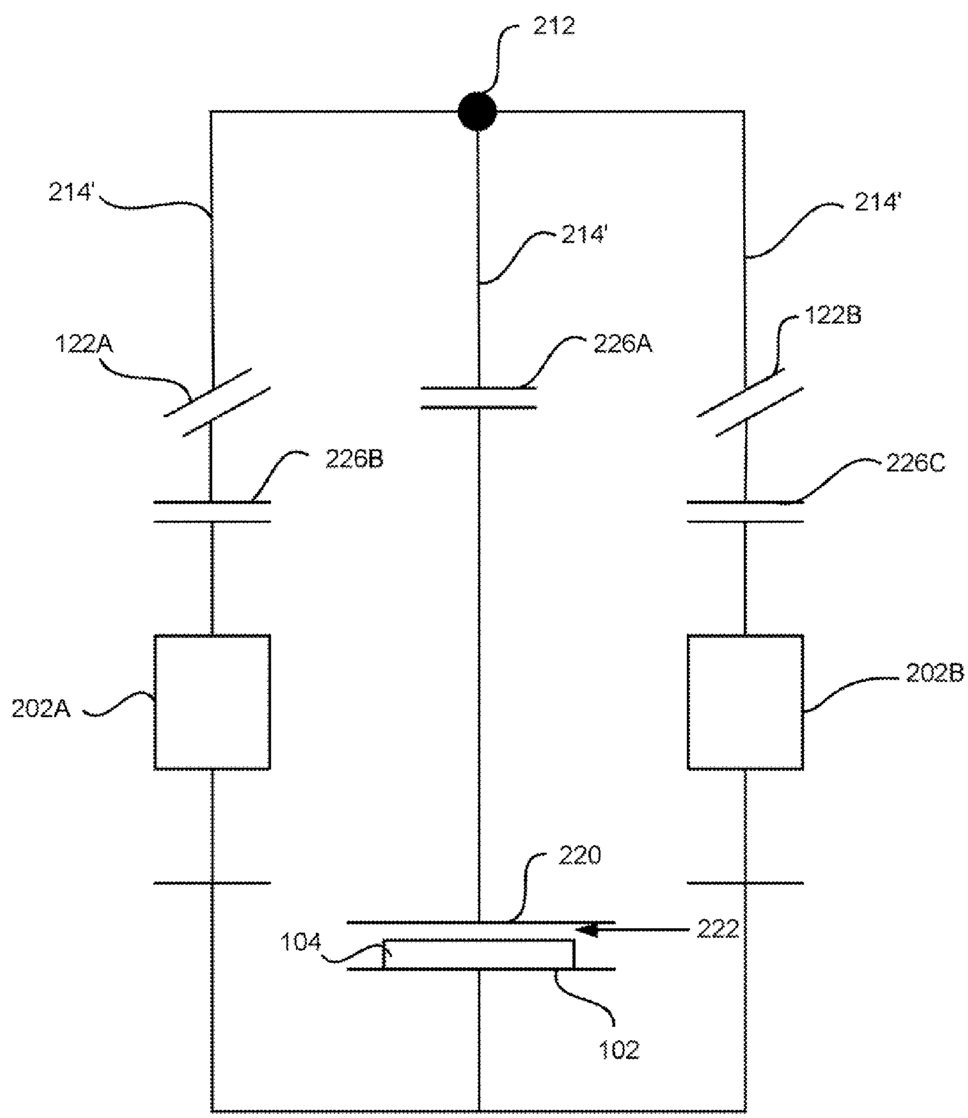
Publication Classification

(51) **Int. Cl.**
C23F 1/08 (2006.01)

(52) **U.S. Cl.** **156/345.27**

(57) **ABSTRACT**

Passive wafer gap compensation arrangements and methods relying on temperature-driven dimensional change of thermally expanding component(s) to counteract, substantially or partially, the change in the wafer gap due to chamber component temperature change is provided. The passive arrangements and techniques involve passively raising or lowering the substrate-facing component or the substrate support to counteract, substantially or partially, the gap-narrowing effect or gap-expanding effect of rising temperature, thereby reducing or eliminating the change in the wafer gap due to a change in the chamber component temperature. Cooling arrangement(s) and thermal break(s) are optionally provided to improve performance.



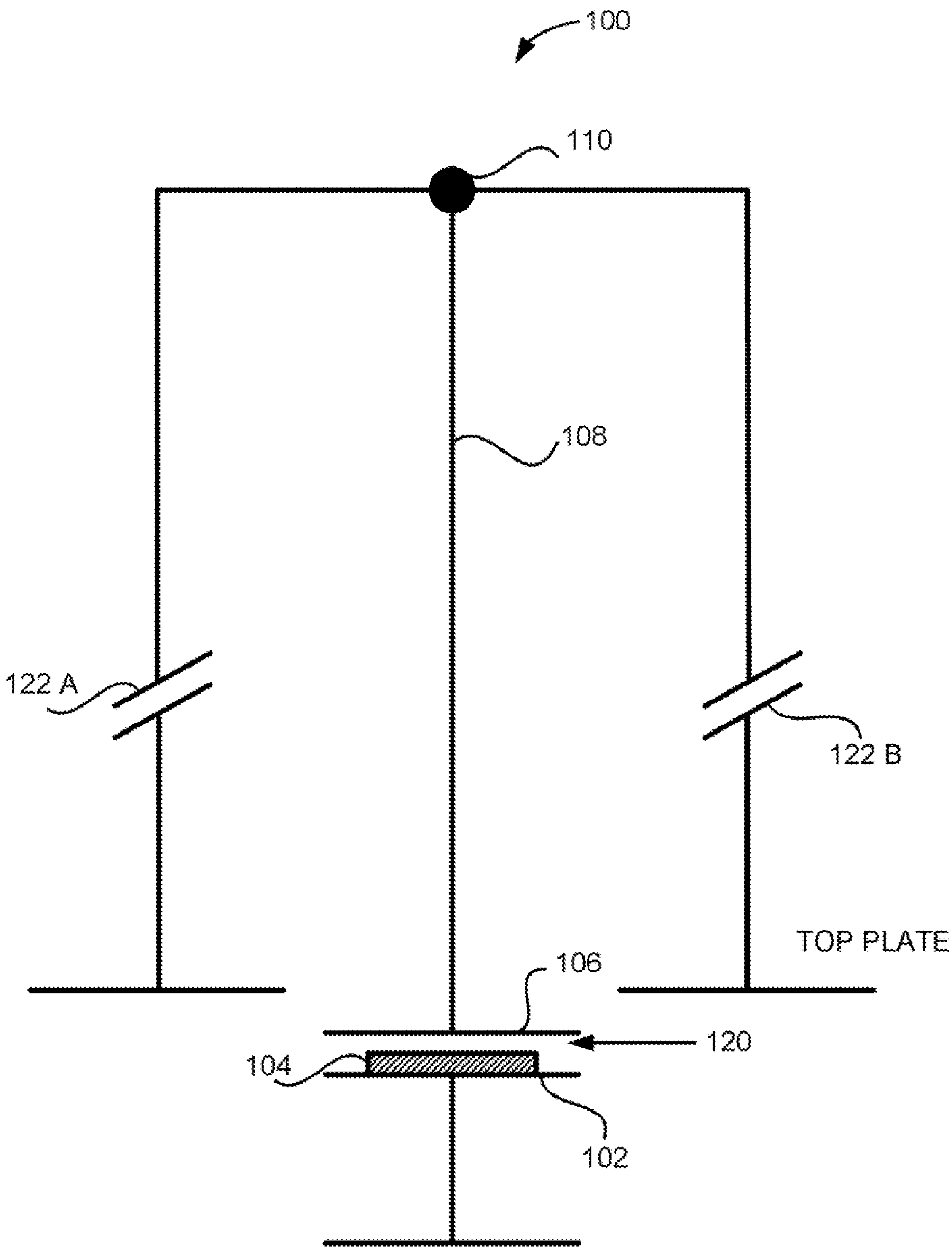


FIG. 1

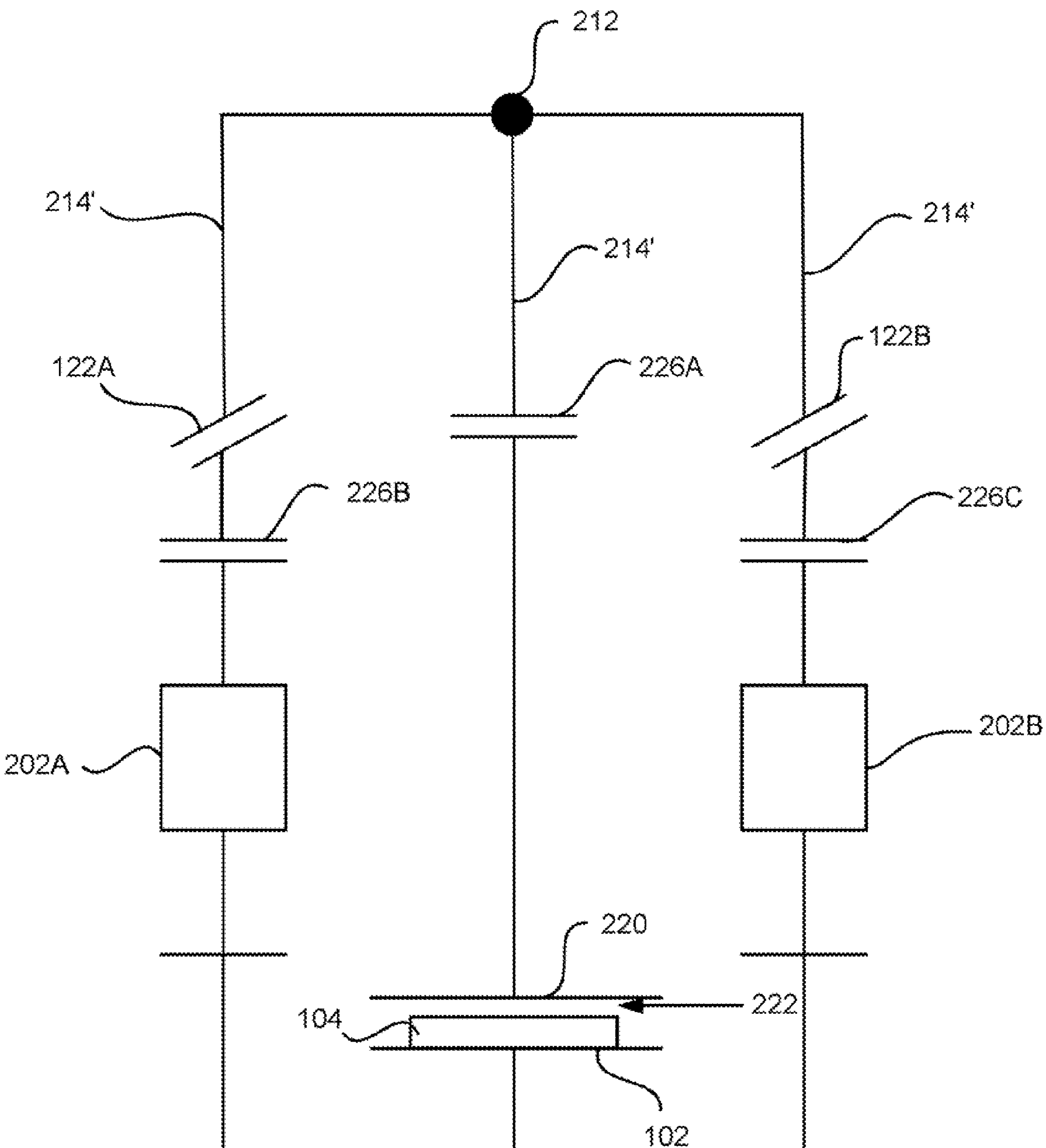

212
214'
214'
214'
122A
226A
122B
226B
226C
202A
202B
220
222
104
102

FIG. 2

PASSIVE COMPENSATION FOR TEMPERATURE-DEPENDENT WAFER GAP CHANGES IN PLASMA PROCESSING SYSTEMS

BACKGROUND OF THE INVENTION

[0001] Plasma has long been employed to process substrates (e.g., wafers, flat panels, etc.) into electronic products (such as semiconductor integrated circuits, flat panel displays, LCDs, etc.). Plasma-enhanced processing of substrates typically involves disposing a substrate in a plasma processing chamber of a suitable plasma processing system (such as a plasma processing cluster tool), positioning the substrate on a work piece holder or chuck, introducing an appropriate source gas into the chamber, and exciting the source gas into a plasma in accordance with a specific recipe for deposition or etching purpose.

[0002] As feature sizes on the substrate become smaller and smaller and process requirements become more stringent, there is a need to more tightly control the process parameters to ensure that the etch or deposition result is satisfactory. One of the parameters to be controlled during plasma processing is the state of the wafer bevel, which resides at the outer edge of the wafer. At the bevel, films are deposited during the build of the devices under high mechanical tension or stress. During wafer processing and handling these films may flake off and may form defects on the face of the wafer, leading to a reduction of die yield. One of the parameters to be particularly well controlled in bevel etch processing applications involves the wafer gap. As the term is employed herein, the wafer gap pertains to the distance between upper electrode (which may be grounded or may be powered with a DC or RF power source or the like or may be an insulating plate or a combination of electrically insulating and conducting materials) and the substrate. More specifically in the bevel etch example herein, the wafer gap refers to the distance between the lower surface of the upper insulator plate that is disposed above and in a spaced-apart relationship with the substrate (for the purpose of inhibiting plasma formation in the center region of the substrate where plasma processing is not desired during bevel etch) and the upper surface of the substrate. In bevel etch applications, the wafer gap is critical for controlling the etch boundary toward the center of the wafer. This etch boundary is defined as the radius below which the etch rate of the substrate has dropped below a certain threshold such that etching becomes insignificant. This threshold is normally around 50 nm/min. In other words, this critical gap determines how far plasma may encroach from the outer regions around the wafer toward the center of the wafer. This encroachment distance is application specific but ranges typically in the order of 500 micrometers measured from the very edge (the apex) of the wafer.

[0003] Generally speaking, the wafer gap is controlled by a drive mechanism, which raises or lowers the upper insulator plate as necessary to, for example, facilitate loading and unloading of the substrate and to control the aforementioned wafer gap for different applications. By way of example, some drive mechanisms may employ a stepper motor and/or associated gearing or screw arrangements to finely control the wafer gap in accordance with a wafer gap value set by the process recipe.

[0004] The plasma-enhanced processing of substrates may, in some cases, involve elevated substrate and chamber hardware temperatures. For example, some bevel etch recipes may call for substrate and chamber hardware temperatures in the range of about 80 degrees Celsius or higher. This elevated temperature is achieved by actively heating chamber components, and it has been observed that as chamber components heat up, the thermal expansion of these chamber components changes the wafer gap. The wafer gap change due to thermal expansion is significant enough to warrant a re-calibration of the chamber gap at various temperatures to account for the temperature-dependent change in the wafer gap. Recalibration adds to the time that the module is offline as it requires the chamber to be opened and is hence undesirable. In addition, the need for a temperature-dependent gap re-calibration would prevent a user of the tool to process a given wafer at different temperatures in a single run. The ability of such an on-the-fly temperature change may be a desirable process knob for some bevel etch applications.

[0005] For example, it may be necessary in some cases to change the wafer gap value that is employed by the drive mechanism to re-position the upper insulator plate in order to account for the temperature-related thermal expansion. In an example bevel etch application, the wafer gap may be as little as 350 micrometers and temperature-related thermal expansion may, in some systems, cause the wafer gap to shrink by approximately 3% of its specified value for every 10 degrees C. of temperature change. By increasing the wafer gap value in the recipe to account for the temperature-related wafer gap shrinkage, the drive mechanism may be able to provide some degree of compensation as chamber components heat up.

[0006] As mentioned, calibration of the wafer gap is however a labor intensive and time-consuming process and is a relatively cumbersome way of handling the thermal expansion issue that affects the wafer gap. Embodiments of the invention provide improved arrangements and methods to address the temperature-related thermal expansion issue that affects the wafer gap in plasma processing systems.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0008] FIG. **1** shows a simplified conceptual diagram of a typical plasma processing chamber to facilitate discussion.

[0009] FIG. **2** shows, in accordance with an embodiment of the invention, a simplified conceptual diagram of a plasma processing chamber having an implementation of the passive wafer gap compensation arrangement.

DETAILED DESCRIPTION OF EMBODIMENTS

[0010] The present invention will now be described in detail with reference to a few embodiments thereof as illustrated in the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without some or all of these specific details. In other instances, well known process steps and/or structures have not been described in detail in order to not unnecessarily obscure the present invention.

[0011] Embodiments of the invention relate to passive compensation arrangements and methods for counteracting the change in the wafer gap due to temperature changes. In one or more embodiments, if the wafer gap tends to be reduced when chamber components heat up (e.g., due to a change in the temperature set point of the system or due to extended operation), auxiliary hardware in the form of thermally expanding components are added to passively move (e.g., raise) the upper insulator plate at the same rate. Through passive mechanical subtraction or cancellation, the wafer gap is maintained substantially constant irrespective of temperature changes.

[0012] As employed herein, the term "passive" denotes that embodiments of the invention involve means other than an actuator (such as one electrically, hydraulically, magnetically, mechanically, or pneumatically powered) to compensate for the change in the wafer gap. It should be noted that in any given system implementing one or more embodiments of the invention, the existing actuator employed to actively drive position the upper insulator plate may still be employed to provide some active compensation as before, but embodiments of the invention that passively compensate do not employ that gap drive mechanism to accomplish its portion of the compensation. To put it differently, the passive compensation approaches discussed herein do not employ an active actuator, although the invention does not require that passive compensation be the only wafer gap compensation mechanism in the plasma processing system. Thus, the passive compensation approach of embodiments of the invention herein may exist alone or in cooperation with existing prior art active compensation approaches employing, for example, the gap drive mechanism.

[0013] For example, embodiments of the invention do not employ an actuator to drive the upper insulator plate away or toward the substrate support or the lower electrode to compensate for or counteract the gap-narrowing or gap-expanding effect due to a change in temperature. Although the drive mechanism of the prior art may initially set the wafer gap or calibrate the wafer gap at different values in response to a change in temperature, such active compensation strategies are not required for the present invention (although such prior art compensation strategies may exist together with embodiments of the invention in a given plasma processing system). Rather, embodiments of the invention rely on the thermally driven dimensional change (e.g., temperature-drive expansion property) of the thermally expanding components to mechanically subtract out or mechanically counteract the aforementioned wafer gap-narrowing or expanding.

[0014] It should be noted from the outset that in the discussion herein, specific examples of thermally expanding components are discussed to passively counteract, substantially or partially, the gap-narrowing effect of rising chamber component temperature. However, the invention is neither limited to the explicitly discussed examples herein nor to the gap-narrowing effect only. It should be understood that the invention also covers situations wherein the wafer gap is widened or expanded due to rising chamber component temperature, and appropriately deployed thermally expanding components may also be employed to passively counteract, substantially or partially, the wafer gap-expanding effect due to rising chamber component temperature. Modifications to the method of attachment, positioning, attachment sites, etc., of the thermally expanding components to passively counteract, substantially or partially, the gap-narrowing or gap-expanding effect of rising temperature is within the skills of one of ordinary skill in the art given this disclosure. Further, although a temperature rise is employed to illustrate the example, a gap change (opening or closing) may also be caused by a temperature reduction. The principles discussed herein apply equally in such a scenario.

[0015] In one or more embodiments, the thermally expanding components are coupled with support structures that mechanically support the upper insulator plate above the wafer, thereby raising the upper insulator plate as the thermally expanding components expand in response to a rise in temperature. For example, if the upper insulator plate is coupled to a reference mechanical support point of the chamber structure via an upper insulator plate support assembly, the thermally expanding component(s) may be employed to raise the reference mechanical support point in response to a rise in temperature. In this manner, as the upper insulator plate support structure expands or elongates responsive to a rise in temperature (which temperature rise tends to narrow the wafer gap in one example), the same rise in temperature also expands the thermally expanding component(s) to raise the reference mechanical point to raise the upper insulator plate, thereby substantially or partially counteracting the wafer gap-narrowing effect of rising temperature.

[0016] In a similar manner, appropriately deployed thermally expanding components are also used to passively counteract, substantially or partially, the wafer gap expanding effect if such is the case when the temperature rises.

[0017] In one or more embodiments, to improve the efficiency of the passive compensation arrangement, at least a portion of the aforementioned upper insulator plate support structure (and/or other components) may be thermally isolated to prevent that portion from elongating or expanding, thereby minimizing the amount by which the wafer gap is changed. With less narrowing or expanding to counteract or with fewer wafer gap-changing factors involved, the passive compensation arrangement may be made simpler or more efficient or smaller in size.

[0018] The features and advantages of embodiments of the invention may be better understood with reference to the figures and discussions that follow. FIG. **1** shows a simplified conceptual diagram of a typical plasma processing chamber **100**, including substrate support **102** for supporting wafer **104** during processing. In an embodiment, substrate support **102** is an electrode. In another embodiment, substrate support **102** is a work piece holder. In yet another embodiment, substrate support **102** may be a chuck.

[0019] A substrate-facing component is shown coupled to a substrate-facing component support structure. In the example of FIG. **1**, the substrate-facing component is in the form of upper insulator plate **106** and is shown coupled to upper insulator plate support structure **108**, which serves to couple upper insulator plate **106** to a reference mechanical support point **110** of the chamber structure. It should be understood that although substrate-facing component **106** is an upper insulator plate in the example of FIG. **1**, embodiments of the invention also apply to situations where the substrate-facing component is an upper electrode (which may be powered or grounded, for example, and may be DC-biased if desired.

[0020] By way of example, the reference mechanical support point **110** may be a chamber structural component (or portion thereof) that is intended for coupling with upper insulator plate support structure **108** in order to suspend upper insulator plate **106** above wafer **104**, thereby creating a wafer gap **120** during processing.

[0021] Wafer gap **120** may be driven by drive mechanism **122**, represented in FIG. **1** by reference numbers **122**A and **122**B, in order to facilitate wafer loading and unloading as well as to drive wafer gap **120** to some predefined wafer gap value specified by the process recipe. During processing, a plasma is created in the bevel region from injected process gas(es) to process (e.g., etch) the bevel region. The narrow wafer gap maintained above the wafer ensures that plasma is not formed over the center portion of the substrate, since plasma processing of the interior region of the substrate is generally not desirable during bevel processing.

[0022] Generally speaking, drive mechanism **122** is configured to drive the wafer gap to a certain position using its precision motor/gear combination in conjunction with a position decoder for feedback. Once the wafer gap is driven to the recipe-specified position by wafer drive mechanism **122**, the wafer gap is deemed set and processing may commence if other recipe parameters (such as RF power, pressure, gas flow, etc.) are also set.

[0023] In some situations, however, the chamber hardware may reach fairly a high temperature, e.g., around 80 degrees Celsius, for certain bevel etch applications. The plasma chamber and its components may be calibrated at a lower temperature (such as room temperature) but may be operated at a high temperature, for example. The chamber components, being made of different materials and having different heat capacitances and physical lengths, may expand at different rates and may experience different length changes as a function of time and temperature.

[0024] This increase in the temperature in the chamber components may affect the wafer gap in various ways. In some chambers, the wafer gap narrows in response to a rise in temperature. In other chambers, the wafer gap may expand as mentioned earlier. This change is sufficiently concerning in many applications, including bevel etch applications in which the gap is fairly small (e.g., under 700 micrometers) and changes in temperature in the range between room temperature and the highest process temperature (which chamber components may acquire after the chamber has operated for some time) may vary the pre-set wafer gap up to 3% for every 10 C temperature rise. For example, with respect to a chamber heated to 120 degrees C. (room temp being 20 degrees C., for example), the chamber components may undergo a 100 degrees C. change and the gap may change by 30%. This large percentage variation in the wafer gap has a significant impact on the bevel etch result. For example, the bevel etch rate for a narrower-than-intended wafer gap allows for less plasma encroachment above the wafer, thereby lowering the etch rate at a given distance from the bevel apex. This temperature-dependent variation due to wafer gap change may lead to a shift of the etch front further out toward the apex of the wafer than is desirable thereby reducing the yield-enhancing benefits of the bevel tool. A smaller gap is also a problem because some wafers are not flat. The nominal gap may be better able to account for the out-of-flat condition of production wafers. Reducing the gap undesirably increases the risk of the upper insulator plate touching the upper, device-side of the substrate.

[0025] In one or more embodiments, thermally expanding components are coupled with support structures that mechanically support the upper insulator plate above the wafer to passively raise the upper insulator plate as the thermally expanding components expand in response to a rise in temperature, thereby canceling out aforementioned wafer gap-narrowing effect. FIG. **2** shows a simplified conceptual diagram of a typical plasma processing chamber that employs thermally expanding components to passively maintain the wafer gap substantially constant and independent of temperature changes.

[0026] With reference to FIG. **2**, thermally expanding components **202**A/**202**B are added to the assembly in a manner that produces a gap increase as thermally expanding components **202**A/**202**B expand due to an increase in the temperature of heated plate **210**. Two thermally expanding components **202**A and **202**B are shown although a single cylindrical structure (or other structural shapes) may be employed as the thermally expanding structure. In other embodiments, a larger or fewer number of thermally expanding components may be employed as desired to raise or lower the upper insulator plate by the desired amount as the temperature changes.

[0027] As the temperature rises, thermally expanding components **202**A/**202**B expand, thereby passively moving reference mechanical support point **212** upward in the example of FIG. **2**. This passive raising of reference mechanical support point **212** also passively raises upper insulator plate **220** (since upper insulator plate **220** is coupled to reference mechanical support point **212** via upper plate support structure **214**), thereby expanding wafer gap **222**. This expansion of the wafer gap **222** has the effect of counteracting the aforementioned temperature-driven gap-narrowing effect, thereby mechanically and passively subtracting or canceling out (wholly or partially) the temperature-driven gap-narrowing effect. In the example of FIG. **2**, the expansion of wafer gap **222** effectively counteracts the temperature-driven expansion of plate support structure **214**.

[0028] It should be noted that many complex factors may contribute to the narrowing of the wafer gap in response to a rise in the temperatures of the various chamber component parts. One way to characterize the effect of the temperature rise on the wafer gap may be to empirically measure the wafer gap at various temperatures or after a certain number of cycles have been run. A table may be created to correlate temperature/number of wafers processed with wafer gap shrinkage, for example. It has been discovered that although there may be complex factors contributing to the change in the wafer gap, a net narrowing effect may be empirically obtained for the wafer gap in response to a rise in temperature, and the net narrowing effect may, in this manner, be measured and quantified irrespective of the complexity of the chamber construction.

[0029] The quantification of the gap-narrowing effect can be employed to select the appropriate structure or shape or size of the thermally expanding component(s) to best counteract (wholly or partially as desired) or to cancel out the temperature-dependent gap-narrowing effect. In this manner, as the upper plate support structure expands or elongates responsive to a rise in temperature (thereby tending to narrow the wafer gap) and the heating of other chamber components may add to or reduce the gap-narrowing effect, the same rise in temperature also expands the thermally expanding component(s) to raise reference mechanical point **212** to raise upper insulator plate **220**, thereby counteracting the wafer gap-narrowing effect of rising temperature.

[0030] In one or more embodiments, thermal breaks may be provided to render the passive compensation arrangement more effective. In some systems, it is observed that because the drive mechanism is made up of many components and is not actively heated, the temperatures of these components are not well controlled. The actual temperatures of these various components are affected by the contact resistance between mating parts, which can vary from assembly to assembly. The result is a variable amount of thermal expansion which would be complex to account for in some cases. By thermally isolating the drive assembly, the resultant temperature-driven dimensional change, which is a composite of various contributory gap-expanding effects and gap-widening effects attributable to the different temperature-driven responses of different parts and components, tend to be more repeatable from chamber to chamber, thereby making compensation more straightforward.

[0031] With reference to FIG. **2**, if the entire upper plate support structure **214** had been allowed to expand or elongate in response to a rise in temperature, such expansion or elongation may partially or wholly cancel out the expansion or elongation provided by thermally expanding components **202**A/**202**B by driving upper plate **220** downward toward the wafer.

[0032] By providing thermal breaks **226**A, **226**B, and **226**C and optionally using an appropriate heating/cooling system to actively maintain stable the temperature of the portion of the upper plate support structure denoted by reference number **214'**, any high-temperature driven gap change is countered by the thermally expanding components. If portion **214'** had been allowed to expand as well as the temperature increases, an expanding portion **214'** would drive the gap close again, thereby at least partially or substantially negating, in an undesirable manner, the function of the thermally expanding components.

[0033] Other chamber components may also be thermally isolated and/or provided with cooling arrangements in order to simplify the compensation arrangement and/or make the compensation arrangement smaller and/or more effective. In one or more embodiments, the drive mechanism may be thermally isolated to render the drive mechanism immune from the thermal expansion effects of increasing temperatures.

[0034] In one or more embodiments, upper plate support structure **214** may be heated/cooled in a manner that tracks the heating/cooling of thermally expanding components **202**A/**202**B in order to ensure that these components expand/contract at substantially the same rate. In other embodiments, upper plate support structure **214** may be heated/cooled in a manner that tracks the heating/cooling of thermally expanding components **202**A/**202**B in order to ensure that these components expand/contract at different rates yet substantially cancel out the narrowing/expansion of thee wafer gap. In one or more embodiments, the same heating/cooling liquid (such as Fluorinert or another suitable heating/cooling liquid) may be routed to both upper plate support structure **214** and thermally expanding components **202**A/**202**B to ensure that their temperature change is substantially identical.

[0035] It should be noted that although the thermally expanding components are shown coupled to positions **202**A/**202**B, other ways to couple the thermally expanding components to chamber components are possible. As long as the thermally expanding components are employed to passively counteract (partially or wholly) the temperature-driven wafer gap-narrowing effect, the thermally expanding components may be added in any suitable locations and/or attached to any suitable components of the plasma chamber. For example, it is possible to passively lower the substrate support instead of passively raising the upper plate in order to compensate for the temperature-driven wafer gap-narrowing effect. Further, although three thermal breaks are provided, the number of thermal breaks and/or cooling arrangements may vary as desired as long as they contribute to the passive counteracting (partially or wholly via the expansion of the thermally expanding components) of the above-discussed temperature-driven wafer gap-narrowing effect.

[0036] As can be appreciated from the foregoing, embodiments of the invention advantageously and passively compensate for the change in the wafer gap due to temperature changes. Since complicated active control and/or feedback schemes are not required to counteract the temperature-driven wafer gap-narrowing effect, embodiments of the invention can be reliably and inexpensively implemented. By employing the expansion property of the thermally expanding component(s) and simple mechanical subtraction principles to mechanically cancel out (partially or wholly) the wafer-gap-narrowing effect of increasing temperatures, embodiments of the invention can keep the wafer gap substantially constant and/or significantly reduce the amount by which the wafer gap is narrowed in order to render the process result more repeatable and predictable irrespective of temperature changes.

[0037] While this invention has been described in terms of several preferred embodiments, there are alterations, permutations, and equivalents, which fall within the scope of this invention. For example, although the specific examples herein discuss a bevel etch chamber and provide specific methods of attaching the thermally expanding components as well as specific locations for such attachment, it should be understood that invention is equally applicable to other processing applications involving deposition and/or etching, whether or not bevel processing is involved.

[0038] Further, although the specific examples herein passively raise or lower the substrate-facing component to change the wafer gap, it should be understood that one or more embodiments of the invention can be applied to situations wherein the substrate support is passively raised/lowered to change the wafer gap. Additionally, although the specific examples herein address a temperature-driven gap-narrowing situation, it should be understood that the invention can also be applied to address a temperature-driven gap-expanding situation. Accordingly, it is offered that there are many alternative ways of implementing the methods and apparatuses of the present invention, all of which are within the skills of one of ordinary skill in the art given this disclosure. Although various examples are provided herein, it is intended that these examples be illustrative and not limiting with respect to the invention.

What is claimed is:

1. A plasma processing system for processing a substrate, said plasma processing system having at least a chamber, said chamber having at least a substrate support and a substrate-facing component that faces an upper surface of said substrate in a spaced-apart relationship above said substrate, said substrate disposed on top of said substrate support and between said substrate support and said substrate-facing component during said processing, comprising:

substrate-facing component support structure coupled between said substrate-facing component and an upper chamber component of said plasma processing chamber to position said substrate-facing component above said substrate during said processing such that a desired gap exists between a lower surface of said substrate-facing component and an upper surface of said substrate; and means for passively moving said substrate-facing component responsive to temperature change experienced by at least one component of said plasma processing chamber, said temperature change experienced by said at least one component causing said desired gap to change if said substrate-facing component is not passively moved, said means for passively moving said substrate-facing component relying on thermally-driven dimensional change of said means to accomplish said moving.

2. The plasma processing system of claim **1** wherein said substrate-facing component is an upper insulator plate and where in said chamber is a bevel etch chamber.

3. The plasma processing system of claim **1** wherein said substrate-facing component is an upper electrode.

4. The plasma processing system of claim **1** wherein said substrate support is a lower electrode.

5. The plasma processing system of claim **1** wherein said change represents a narrowing of said desired gap when said at least one component experiences an increase in temperature, said means for passively moving configured to raise said substrate-facing component responsive to said narrowing.

6. The plasma processing system of claim **1** wherein said change represents an expansion of said desired gap when said at least one component experiences an increase in temperature, said means for passively moving configured to lower said substrate-facing component responsive to said expansion.

7. The plasma processing system of claim **1** wherein said passively moving includes passively moving said upper chamber component.

8. The plasma processing system of claim **1** wherein said upper chamber component includes an attachment site for attaching said substrate-facing component support structure.

9. The plasma processing system of claim **1** wherein said means for passively moving includes at least one thermal break.

10. The plasma processing system of claim **1** wherein said means for passively moving includes at least one thermally expanding component.

11. The plasma processing system of claim **1** wherein said means for passively moving includes a plurality of thermally expanding components configured for symmetrically moving said substrate-facing component responsive to temperature change.

12. The plasma processing system of claim **1** wherein said means for passively moving is configured to substantially cancel out an amount by which said desired gap would have been changed in the absence of said means for passively moving if a temperature of said at least one component is increased.

13. The plasma processing system of claim A**1** wherein said means for passively moving includes a cooling subsystem.

14. A plasma processing system for processing a substrate, said plasma processing system having at least a chamber, said chamber having at least a substrate support and a substrate-facing component that faces an upper surface of said substrate in a spaced-apart relationship above said substrate, said substrate disposed on top of said substrate support and between said substrate support and said substrate-facing component during said processing, comprising:

substrate-facing component support structure coupled between said substrate-facing component and an upper chamber component of said plasma processing chamber to position said substrate-facing component above said substrate during said processing such that a desired gap exists between a lower surface of said substrate-facing component and an upper surface of said substrate; and

means for passively moving said substrate support responsive to temperature change experienced by at least one component of said plasma processing chamber, said temperature change experienced by said at least one component causing said desired gap to change if said substrate support is not passively moved, said means for passively moving said substrates support relying on thermally-driven dimensional change of said means to accomplish said moving.

15. The plasma processing system of claim **14** wherein said substrate-facing component is an upper insulator plate and where in said chamber is a bevel etch chamber.

16. The plasma processing system of claim **14** wherein said substrate-facing component is an upper electrode.

17. The plasma processing system of claim **14** wherein said substrate support is a lower electrode.

18. The plasma processing system of claim **14** wherein said change represents a narrowing of said desired gap when said at least one component experiences an increase in temperature, said means for passively moving configured to lower said substrate support responsive to said narrowing.

19. The plasma processing system of claim **14** wherein said change represents an expansion of said desired gap when said at least one component experiences an increase in temperature, said means for passively moving configured to raise said substrate support responsive to said expansion.

20. The plasma processing system of claim **14** wherein said means for passively moving includes at least one thermal break.

21. The plasma processing system of claim **14** wherein said means for passively moving includes at least one thermally expanding component.

22. The plasma processing system of claim **14** wherein said means for passively moving includes a plurality of thermally expanding components configured for symmetrically moving said substrate support responsive to temperature change.

23. The plasma processing system of claim **14** wherein said means for passively moving is configured to substantially cancel out an amount by which said desired gap would have been changed in the absence of said means for passively moving if a temperature of said at least one component is increased.

24. The plasma processing system of claim **14** wherein said means for passively moving includes a cooling subsystem.

* * * * *