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(54) Title: DEPOSITION APPARATUS

(57) Abstract: Disclosed is a deposition apparatus. The deposition apparatus includes a chamber, a susceptor in the chamber, and a wafer holder in the susceptor. The susceptor includes a susceptor upper plate and a susceptor lower plate facing the susceptor upper plate, and the susceptor upper plate includes a protrusion part.

Description

Title of Invention: DEPOSITION APPARATUS

Technical Field

[1] The discloser relates to a deposition apparatus.

Background Art

[2] In general, among technologies to form various thin films on a substrate or a wafer, a CVD (Chemical Vapor Deposition) scheme has been extensively used. The CVD scheme results in a chemical reaction. According to the CVD scheme, a semiconductor thin film or an insulating layer is formed on a wafer surface by using the chemical reaction of a source material.

[3] The CVD scheme and the CVD device have been spotlighted as an important thin film forming technology due to the fineness of the semiconductor device and the development of high-power and high-efficiency LED. Recently, the CVD scheme has been used to deposit various thin films, such as a silicon layer, an oxide layer, a silicon nitride layer, a silicon oxynitride layer, or a tungsten layer, on a wafer.

[4] In particular, an HW-CVD (Hot Wall Chemical Vapor Deposition) device using a high-temperature wall reactor includes a susceptor serving as the passage of gas and fixing the wafer. Deposits are stuck onto the susceptor or undesired impurities are generated on such a susceptor, so that the wafer may be defected.

Disclosure of Invention

Technical Problem

[5] The embodiment provides a deposition apparatus capable of increasing the reliability of the deposition process, and forming a high-quality thin film.

Solution to Problem

[6] According to the embodiment, the deposition apparatus includes a chamber, a susceptor in the chamber, and a wafer holder in the susceptor. The susceptor includes a susceptor upper plate and a susceptor lower plate facing the susceptor upper plate, and the susceptor upper plate includes a protrusion part.

Advantageous Effects of Invention

[7] As described above, according to the deposition apparatus according to the embodiment, protrusion parts are formed on an upper plate of the susceptor, so that the adhesion between the upper plate of the susceptor and the impurities can be increased. Accordingly, impurities are infiltrated onto the substrate mounted on the lower plate of the susceptor, thereby preventing defects from being caused.

[8] The difference is made in concentration between the upper and lower plates of the susceptor, thereby preventing Si droplets generated in reaction between redundancy Si

atoms and the substrate after the deposition process has been performed.

[9] Therefore, the reliability of the deposition process can be increased, and the high-quality thin film can be formed.

Brief Description of Drawings

[10] FIG. 1 is a sectional view showing a deposition apparatus according to the embodiment;

[11] FIG. 2 is a perspective view showing a susceptor; and

[12] FIG. 3 is an exploded perspective view of a portion A of FIG. 2.

Mode for the Invention

[13] In the description of the embodiments, it will be understood that, when a layer (or film), a region, a pattern, or a structure is referred to as being "on" or "under" another substrate, another layer (or film), another region, another pad, or another pattern, it can be "directly" or "indirectly" on the other substrate, layer (or film), region, pad, or pattern, or one or more intervening layers may also be present. Such a position of the layer has been described with reference to the drawings.

[14] The thickness and size of each layer shown in the drawings may be exaggerated, omitted or schematically drawn for the purpose of convenience or clarity. In addition, the size of elements does not utterly reflect an actual size.

[15] Hereinafter, the embodiment will be described in detail with reference to accompanying drawings.

[16] A deposition apparatus according to the embodiment will be described in detail with reference to FIGS. 1 to 3. FIG. 1 is a sectional view showing a deposition apparatus according to the embodiment, and FIG. 2 is a perspective view showing the susceptor. FIG. 3 is an enlarged perspective view of a portion A of FIG. 2.

[17] FIG. 2 is a perspective view showing only the susceptor of FIG. 1. A section taken along line I-I of FIG. 2 is shown in FIG. 1.

[18] Referring to FIGS. 1 and 2, the deposition apparatus according to the embodiment includes a chamber 10, heating elements 60, a heat retaining unit 20 to retain heat, a susceptor 30, and a wafer holder 40 provided in the susceptor 30.

[19] Hereinafter, the deposition apparatus will be described in more detail.

[20] The chamber 10 has the shape of a cylinder or a rectangular box. The chamber 10 is provided therein with a space allowing the handling of the wafer 40. Although not shown, the chamber 10 may be additionally provided at one side thereof with a gas inlet allowing precursors to be introduced and a gas outlet allowing gas discharge.

[21] Such a chamber 10 prevents the introduction of external gas and maintains the degree of vacuum. To this end, the chamber 10 may include quartz representing high mechanical strength and superior chemical durability.

[22] The chamber 10 is provided at the outside thereof with the heating elements 60.

[23] The heating elements 60 may include resistance heating elements to generate heat in a power-on state, and may be arranged at a predetermined interval so that the wafer 50 can be uniformly heated. In order to arrange the heating elements 60 in a predetermined form, the heat elements 60 may have the form of a wire. For example, the heating elements 60 may include a filament, a coil, or a carbon wire.

[24] Thereafter, the heat retaining unit 20 may be provided in the chamber 10. The heat retaining unit 20 retains heat in the chamber 10. In addition, the heat emitted from the heating elements 60 can be efficiently transferred to the susceptor 30.

[25] The heat retaining unit 20 includes a material that is not deformed by the heat emitted from the heating elements 60, but stabilized chemically. For example, the heat retaining unit 20 may include nitride ceramic, carbide ceramic or graphite.

[26] Thereafter, the susceptor 30 is located on the heat retaining unit 20.

[27] In the deposition apparatus according to the embodiment, the wafer 50 having deposits formed thereon or subject to epitaxial growth is placed on the susceptor 30.

[28] Referring to FIG. 2, the susceptor 30 may include a susceptor upper plate 37, a susceptor lower plate 38, and susceptor lateral plates 36. In addition, the susceptor upper and lower plates 37 and 38 face each other.

[29] The susceptor 30 may be manufactured by placing the susceptor upper and lower plates 37 and 38 placing the susceptor lateral plates 36 at both sides of the susceptor upper and lower plates 37 and 38, and bonding the susceptor upper and lower plates 37 and 38 with the susceptor lateral plates 36.

[30] However, the embodiment is not limited thereto. Accordingly, a space for a gas passage is made in the rectangular parallelepiped susceptor 39.

[31] A wafer holder 40 may be placed on the susceptor lower plate 38 to fix the wafer 50 to be deposited.

[32] Air flows through the space between the susceptor upper and lower plates 37 and 38, so that the deposition process can be performed. The susceptor lateral plates 36 prevent reactance gas from flowing out when the air flows in the susceptor 30.

[33] In this case, the surfaces areas of the susceptor upper and lower plates 37 and 38 may differ from each other. In detail, the surface area of the susceptor upper plate 37 may be wider than that of the susceptor lower plate 38.

[34] In detail, the susceptor upper plate 37 includes protrusion parts 33, so that the surface area of the susceptor upper plate 37 may be increased. The protrusion parts 33 are formed on a bottom surface of the susceptor upper plate 37, that is, the surface of the susceptor upper plate 37 facing the susceptor lower plate 38.

[35] In particular, when the HW-CVD growth is performed, a great amount of undesired deposits are formed on the susceptor upper plate 37 due to the internal airflow of the

susceptor 30. The deposits are dropped to the wafer 50 to cause undesired reaction to the wafer 50. Accordingly, the wafer 50 may be defected.

[36] According to the embodiment, the protrusion parts 33 are formed on the susceptor upper plate 37, so that the surface area of the susceptor upper plate 37 may be increased. The surface area of the susceptor upper plate 37 is increased, so that the adhesion between the deposits and the susceptor upper plate 37 may be increased. An atom arm structure is destructed on the surface of an object, so that the surface of the object is unstable. In this case, a material of the object tends to be coupled with another material to stabilize the surface of the objection. Therefore, as the surface area of the object is increased, the adhesion can be improved. In other words, the deposits are prevented from being separated from the wafer 50 due to the strong adhesion between the susceptor upper plate 37 and the deposits.

[37] Therefore, the high-quality thin film having the reduced defects can be obtained.

[38] Each protrusion part 33 may have a width W of about 0.1 mm to about 1mm and a thickness T of about 0.1 mm to about 1mm. If the width W and the thickness T of the protrusion part 33 are less than about 0.1m or greater than 1mm, the surface area of the susceptor upper plate 37 is not greatly increased, so that the increase in the adhesion between the deposits and the susceptor upper plate 37 is difficult.

[39] For example, as shown in FIG. 3, the protrusion part 33 may have a cylindrical shape. However, since the embodiment is not limited thereto, the embodiment may include protrusion parts 33 having various shapes, such as a spherical shape, a semi-circular shape, and a polygonal shape, to increase the surface area.

[40] The suscetpor 30 includes graphite representing a high heat resistance property and easily processed, so that the susceptor 30 can endure a high temperature condition. Since the graphite includes a porous material, the graphite may discharge absorption gas during the deposition process. In addition, the graphite reacts with the source gas, so that the surface of the susceptor may be changed into silicon carbide. Accordingly, the thin film of the susceptor may include silicon carbide.

[41] In detail, the susceptor lower plate 38 may include a substrate 34 including graphite and a silicon carbide thin film 35.

[42] In addition, the susceptor upper plate 37 may include a base member 32 including graphite and protrusion parts 33 including silicon carbide. In this case, the protrusion parts 33 may be formed by making a silicon carbide portion in the form of the protrusion parts 33 after depositing silicon carbide on the base member 32.

[43] However, the embodiment is not limited thereto. In other words, the susceptor upper plate 37 may include the protrusion parts 33 formed on a silicon carbide thin film after forming a base member including graphite and forming the silicon carbide thin film on the base member. In this case, the protrusion parts 33 may include silicon carbide. In

other words, after the protrusion parts 33 are separately manufactured, the protrusion parts 33 may be bonded to the susceptor upper plate 37.

[44] Thereafter, the susceptor upper and lower plates 37 and 38 include graphite, and the difference in the density between the susceptor upper and lower plates 37 and 38 is made.

[45] The density of the susceptor upper plate 37 may be 0.1 g/cm^3 to 0.35 g/cm^3 greater than that of the susceptor lower plate 38. As the density of the material is increased, the temperature increase is reduced. Accordingly, the difference can be made in temperature increase between the susceptor upper and lower plates 37 and 38 by making the difference in the graphite density between the susceptor upper and lower plates 37 and 38.

[46] In other words, the temperature of the susceptor lower plate 38 is more rapidly increased than that of the susceptor upper plate 37, and the reactance gas does not move toward the susceptor upper plate 37. Accordingly, silicon carbide reaction of the susceptor upper plate 37 can be prevented, so that Si droplets caused by the silicon carbide reaction can be reduced.

[47] Therefore, when the difference in graphite density between the susceptor upper plate 37 and the susceptor lower plate 38 is less than 0.1 g/cm^3 , the temperatures of the susceptor upper and lower plates 37 and 38 are substantially identically increased, so that the generation of the Si droplets cannot be prevented. In addition, when the difference in graphite density between the susceptor upper plate 37 and the susceptor lower plate 38 is greater than 0.35 g/cm^3, the graphite density of the susceptor lower plate 38 is less than that of the susceptor upper plate 37, so that the graphite density condition required as a susceptor is not satisfied.

[48] In order to increase the difference in the graphite density between the susceptor upper and lower plates 37 and 38, the susceptor upper plate 37 can be manufactured by using a greater amount of graphite than an amount of graphite of the susceptor lower plate 38. In other words, the susceptor upper and lower plates 37 and 38 can be manufactured by using different amounts of graphite in the same thickness, so that the difference in the density between the susceptor upper and lower plates 37 and 38 can be made.

[49] In addition, the difference in the temperature raising speed between the susceptor upper and lower plates 37 and 38 can be made by making the difference in the thickness between the susceptor upper and lower plates 37 and 38. In detail, the difference in the temperature raising speed between the susceptor upper and lower plates 37 and 38 can be made by making the susceptor upper plate 37 thicker than the susceptor lower plate 38. In other words, the temperature raising speed of the susceptor upper plate 37 may be less than the temperature raising speed of the susceptor lower

plate 38 by manufacturing the susceptor upper plate 37 containing a greater amount of graphite than that of the susceptor lower plate 38.

[50] Any reference in this specification to "one embodiment", "an embodiment", "example embodiment", etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[51] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

[Claim 1] A deposition apparatus comprising:
a chamber;
a susceptor in the chamber; and
a wafer holder in the susceptor,
wherein the susceptor includes a susceptor upper plate and a susceptor lower plate facing the susceptor upper plate, and the susceptor upper plate includes a protrusion part.

[Claim 2] The deposition apparatus of claim 1, wherein the protrusion part is formed on a surface of the susceptor upper plate facing the susceptor lower plate.

[Claim 3] The deposition apparatus of claim 2, wherein the protrusion part has a width of about 0.1 mm to about 1 mm.

[Claim 4] The deposition apparatus of claim 3, wherein the protrusion part has a thickness of about 0.1 mm to about 1 mm.

[Claim 5] The deposition apparatus of claim 1, wherein a surface area of the susceptor upper plate differs from a surface area of the susceptor lower plate.

[Claim 6] The deposition apparatus of claim 5, wherein the surface area of the susceptor upper plate is wider than the surface are of the susceptor lower plate.

[Claim 7] The deposition apparatus of claim 1, wherein the susceptor upper and lower plates include graphite.

[Claim 8] The deposition apparatus of claim 7, wherein the susceptor upper plate includes the graphite, and the protrusion part includes silicon carbide.

[Claim 9] The deposition apparatus of claim 7, wherein the susceptor upper plate further includes a graphite member and a silicon carbide thin film placed on the graphite member, and the protrusion part includes silicon carbide.

[Claim 10] The deposition apparatus of claim 7, wherein a density of the susceptor upper plate differs from a density of the susceptor lower plate.

[Claim 11] The deposition apparatus of claim 7, wherein a density of the susceptor upper plate is greater than a density of the susceptor lower plate.

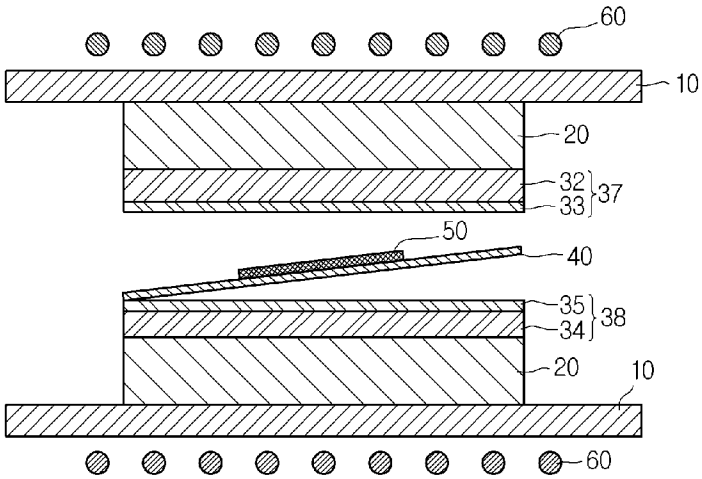
[Claim 12] The deposition deice of claim 11, wherein the density of the susceptor upper plate is about 0.1 g/cm^3 to about 0.35 g/cm^3 higher than the density of the susceptor lower plate.

[Claim 13] The deposition apparatus of one of claims 7 and 11, wherein a

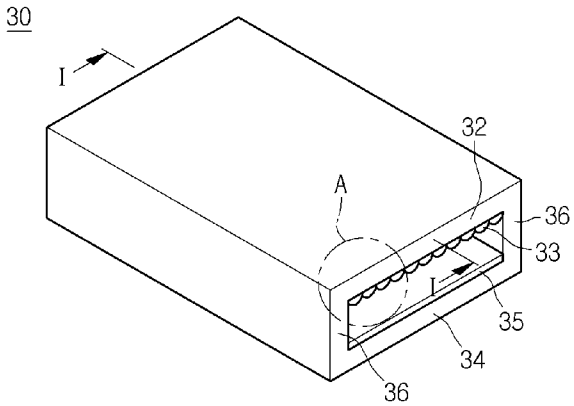
thickness of the susceptor upper plate is thicker than a thickness of the susceptor lower plate.

[Claim 14] The deposition apparatus of claim 1, wherein the chamber is provided therein with a heat retaining unit, and the susceptor is placed on the heat retaining unit.

[Fig. 1]



[Fig. 2]



[Fig. 3]