[0007] Optionally, the emitting component includes a plurality of light-emitting elements disposed at intervals along the vertical direction, the receiving component includes a plurality of light-sensitive elements disposed at intervals along the vertical direction, the plurality of light-emitting elements are configured to transmit the optical signals to the plurality of light-sensitive elements in a one-to-one correspondence manner, and the plurality of light-sensitive elements are configured to receive the optical signals transmitted by the corresponding light-emitting elements, convert the optical signals into the electrical signals, and send the electrical signals to the signal processing device.

[0008] Optionally, the signal processing device is configured to determine a distance between a first light-sensitive element and an active light-sensitive element in the vertical direction according to the electrical signals sent by the light-sensitive elements, and determine the vertical distance between the magnetron component and the target according to the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction and a prestored distance between the first light-sensitive element and the target in the vertical direction; wherein

the first light-sensitive element is a light-sensitive element at a highest position, and the active light-sensitive element is a light-sensitive element in the vertical direction that firstly receives an optical signal and is lower than the light-sensitive elements not receiving the optical signals.

[0009] Optionally, the vertical distance satisfies a following relational expression:

$$D=H-h;$$

where D is the vertical distance between the target and the magnetron component, H is the distance between the first light-sensitive element and the target in the vertical direction, and h is the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction.

[0010] Optionally, the plurality of light-emitting elements are disposed at equal intervals along the vertical direction, the plurality of light-sensitive elements are disposed at equal intervals along the vertical direction and are sequentially numbered along the vertical direction; and the signal processing device is configured to determine the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction according to a difference between a number of the active light-sensitive element and a number of the first light-sensitive element.

component 20 is disposed inside the upper electrode case 60, the rotary drive component 10 is fixedly disposed at a top of the upper electrode case 60, a bottom of the upper electrode case 60 is used for arrangement of the target 70, and the emitting component 30 and the receiving component 40 are both disposed on a side wall of the upper electrode case 60.

[0032] In an alternative implementation of the present disclosure, as shown in FIG. 3, the emitting component 30 includes a plurality of light-emitting elements 31 disposed at intervals along the vertical direction, the receiving component 40 includes a plurality of light-sensitive elements 41 disposed at intervals along the vertical direction, and the plurality of light-emitting elements 31 are configured to transmit the optical signals to the plurality of light-sensitive elements 41 in a one-to-one correspondence manner. The plurality of light-sensitive elements 41 of the receiving component 40 are configured to receive the optical signals transmitted by the corresponding light-emitting elements 31, convert the optical signals into the electrical signals, and send the electrical signals to the signal processing device 50, so that the signal processing device 50 may determine which light-sensitive elements 41 receive the optical signals transmitted by the corresponding light-emitting elements 31 and which light-sensitive elements 41 do not receive the optical signals because the optical signals are blocked by the magnetron component 20, thereby determining the vertical distance between the magnetron component 20 and the target 70.

[0033] In an alternative implementation of the present disclosure, the light-emitting elements 31 are grating emitters, the light-sensitive elements 41 are photosensitive sensors, the grating emitters (the light-emitting elements 31) may transmit the optical signals (e.g., laser) to the corresponding photosensitive sensors (the light-sensitive elements 41) along the horizontal direction, and after receiving the optical signals, the photosensitive sensors convert the optical signals into the electrical signals through a photoelectric effect, and send the electrical signals to the signal processing device 50.

[0034] In an alternative implementation of the present disclosure, the signal processing device 50 is specifically configured to determine a distance between a first light-sensitive element and an active light-sensitive element in the receiving component 40 in the vertical direction according to the electrical signal sent by each light-sensitive element 41, and determine the vertical distance D between the magnetron component 20 and the target 70 according to the distance between the first light-sensitive element and

Claims:

1. An upper electrode structure applied to a semiconductor process chamber, comprising a magnetron component, an emitting component, a receiving component, a target, and a signal processing device; wherein

the magnetron component is located above the target and is configured to provide a magnetic field for an interior of the semiconductor process chamber;

the emitting component and the receiving component are disposed opposite to each other on two sides of the magnetron component along a horizontal direction;

the emitting component is configured to transmit a plurality of optical signals to the receiving component, and the plurality of optical signals are a plurality of light beams that horizontally propagate and are arranged at intervals along a vertical direction;

the receiving component is configured to receive the plurality of optical signals, convert the plurality of optical signals into electrical signals, and send the electrical signals to the signal processing device; and

the signal processing device is configured to determine a vertical distance between the magnetron component and the target according to the electrical signals.

2. The upper electrode structure of claim 1, wherein the emitting component comprises a plurality of light-emitting elements disposed at intervals along the vertical direction, the receiving component comprises a plurality of light-sensitive elements disposed at intervals along the vertical direction, the plurality of light-emitting elements are configured to transmit the optical signals to the plurality of light-sensitive elements in a one-to-one correspondence manner, and the plurality of light-sensitive elements are configured to receive the optical signals transmitted by the corresponding light-emitting elements, convert the optical signals into the electrical signals, and send the electrical signals to the signal processing device.

3. The upper electrode structure of claim 2, wherein the signal processing device is configured to determine a distance between a first light-sensitive element and an active light-sensitive element in the vertical direction according to the electrical signals sent by the light-sensitive elements, and determine the vertical distance

between the magnetron component and the target according to the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction and a prestored distance between the first light-sensitive element and the target in the vertical direction; wherein

the first light-sensitive element is a light-sensitive element at a highest position, and the active light-sensitive element is a light-sensitive element in the vertical direction that firstly receives an optical signal and is lower than the light-sensitive elements not receiving the optical signals.

4. The upper electrode structure of claim 3, wherein the vertical distance satisfies a following relational expression:

$$D=H-h;$$

where D is the vertical distance between the target and the magnetron component, H is the distance between the first light-sensitive element and the target in the vertical direction, and h is the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction.

5. The upper electrode structure of claim 3, wherein the plurality of light-emitting elements are disposed at equal intervals along the vertical direction, the plurality of light-sensitive elements are disposed at equal intervals along the vertical direction and are sequentially numbered along the vertical direction; and the signal processing device is configured to determine the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction according to a difference between a number of the active light-sensitive element and a number of the first light-sensitive element.

6. The upper electrode structure of claim 5, wherein the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction satisfies a following relational expression:

$$h=(i-1)\times t;$$

where h is the distance between the first light-sensitive element and the active light-sensitive element in the vertical direction, i is the number of the active light-sensitive element, and t is a distance between every two adjacent light-sensitive

elements in the vertical direction.

7. The upper electrode structure of claim 5, wherein the signal processing device is further configured to determine a lifting height of the magnetron component according to a difference between a number of a corresponding active light-sensitive element after a height of the magnetron component is changed and a number of a corresponding active light-sensitive element before the height of the magnetron component is changed.

8. The upper electrode structure of claim 7, wherein the lifting height of the magnetron component satisfies a following relational expression:

$$L=(m-n)\times t;$$

where L is the lifting height of the magnetron component, m is the number of the corresponding active light-sensitive element after the height of the magnetron component is changed, n is the number of the corresponding active light-sensitive element before the height of the magnetron component is changed, and t is a distance between every two adjacent light-sensitive elements in the vertical direction.

9. The upper electrode structure of claim 1, further comprising an upper cover, a mounting cylinder, and a rotary drive component; wherein

the upper cover is fixedly disposed at a top end of the mounting cylinder, and the rotary drive component passes through a through hole of the upper cover, and is connected to the magnetron component in the mounting cylinder for driving the magnetron component to rotate; and

a bottom end of the mounting cylinder is used for fixed arrangement of the target, two mounting through holes are formed on a cylinder wall of the mounting cylinder and penetrate through the cylinder wall along a radial direction, the two mounting through holes are arranged opposite to each other on two sides of an axis of the mounting cylinder, and the emitting component and the receiving component are respectively disposed in the two mounting through holes.

10. A semiconductor process chamber, comprising the upper electrode structure of any one of claims 1 to 9.

11. The semiconductor process chamber of claim 10, further comprising a control device, which is configured to give an alarm when the vertical distance exceeds a preset distance range.