claim

1. A thin film deposition device, comprising:

a processing chamber configured for thin film deposition;

a gas supply assembly arranged on the top wall of the processing chamber for supplying process gas to the processing chamber;

a heating tray arranged below the gas supply assembly for bearing and heating a substrate;

a radio frequency source for providing radio frequency power to activate the process gas in the processing chamber to dissociate into plasma and deposit a thin film on the substrate;

a rotating mechanism for controlling the rotation to change the relative position between the substrate and the gas supply assembly or the heating tray, the rotation shaft of the rotating mechanism being perpendicular to the substrate and passing through the substrate;

wherein the radio frequency source is kept in an on state during the rotating mechanism rotating the substrate, or the heating tray, or the gas supply assembly.

2. The thin film deposition device of claim 1, wherein the heating tray is provided with a second through hole, when the substrate or the heating tray is rotated, the radio frequency source is kept in an on state, and the non-process gas is introduced into the gap between the substrate and the heating tray through the second through hole.

3. The thin film deposition device of claim 1, wherein when the substrate rotates or the heating tray rotates or the gas supply assembly rotates, the radio frequency source is kept in an on state and the radio frequency power is adjusted to smaller than it was during the thin film deposition process.

4. The thin film deposition device of claim 1,wherein before the substrate rotates or the heating tray rotates or the gas supply assembly rotates, the RF

source is adjusted to be off and the processing chamber is purified..

5. The thin film deposition device of claim 1, wherein after the thin film deposition is completed,(the substrate rotation times+1) *the setting angle of each time of substrate rotation=360°.

6. The thin film deposition device of claim 1 , wherein the high frequency of the radio frequency source is n times of 13.56 MHz, where n=1, 2, 3, . . ., 8.

7. The thin film deposition device of claim 1, wherein the range of the low frequency of the radio frequency source is 20KHz-400KHz.

8. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S1, placing the substrate in the processing chamber and vacuuming the processing chamber;

S2, introducing process gas into the processing chamber and turning on the radio frequency source to deposit a certain number of layers of thin films on the substrate;

S3, stopping to introduce the process gas and introducing non-process gas to maintain the pressure in the processing chamber;

S4, keeping the radio frequency source in an on state, rotating the substrate or the heating tray or the substrate and the heating tray synchronously by a set angle;

S5, introducing process gas into the processing chamber again and re-depositing a certain number of layers of thin films on the substrate;

S6, stopping to introduce the process gas and introducing non-process gas to maintain the pressure in the processing chamber;

S7, determining whether the number of layers of the film deposited on the substrate meets the requirements; if not, going back to step S2; if yes, executing step S8;

S8, taking out the substrate from the processing chamber.

9. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S11, placing the substrate in the processing chamber and vacuuming the processing chamber;

S12, introducing the process gas into the processing chamber and turning on the radio frequency source to deposit a certain film thickness of thin film on the substrate;

S13, introducing the process gas, keeping the radio frequency source in an on state, rotating the substrate or the heating tray or the substrate and the heating tray synchronously by a set angle;

S14, depositing a thin film on the substrate;

S15, determining whether the thickness of the deposited film on the substrate meets the requirements, if not, going back to step S12; if yes, executing step S16;

S16, taking out the substrate from the processing chamber.

10. The film deposition method of claim 8 or 9, wherein when the substrate or the heating tray is rotated, the radio frequency source is kept in an on state, and the gap between the substrate and the heating tray is adjusted to be smaller than a set value m, where $0<m\leqslant 5mm$.

11. The film deposition method of claim 8 or 9, wherein when the substrate or the heating tray is rotated, the radio frequency source is kept in an on state and non-process gas is introduced into the gap between the substrate and the heating tray..

12. The film deposition method as claimed in claim 8or 9, wherein when the substrate rotates or the heating tray rotates or the substrate and the heating tray rotate synchronously, the radio frequency source is kept in an on state and the radio frequency power is adjusted to be smaller than it was during the thin film deposition process.

13. The film deposition method of claim 8 or 9, wherein before the substrate rotation or the heating tray is rotation or the substrate and the heating tray synchronous rotation, the radio frequency source is adjusted to be off and the processing chamber is purified.

14. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S21, placing the substrate in the processing chamber, and evacuating the processing chamber;

S22, introducing process gas into the processing chamber, and turning on the radio frequency source, depositing a certain number of layers of thin films on the substrate;

S23, stopping to introduce the process gas and introducing non-process gas to maintain the pressure in the processing chamber;

S24, adjusting the radio frequency source to be off, so that the heating tray drives the substrate to rotate synchronously by a set angle;

S25, introducing process gas into the processing chamber, and adjusting the radio frequency source to be on, and depositing a certain number of layers of thin films on the substrate;

S26, stopping to introduce the process gas and introducing non-process gas to maintain the pressure in the processing chamber;

S27, judging whether the number of layers of the film deposited on the substrate satisfies the set number of layers; if not, going back to step S22; if yes, executing step S28;

S28, taking out the substrate from the processing chamber.

15. The thin film deposition method of claim 8 ,9 or 14, wherein after the thin film deposition is completed，wherein (the substrate rotation times+1) *the setting angle of each time of the substrate rotation=360°.

16. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S31, placing the substrate in the processing chamber and evacuating the processing chamber;

S32, introducing process gas into the processing chamber, and turning on the radio frequency source, depositing a certain number of layers of thin films on the substrate;

S33, stopping to introduce the process gas into the processing chamber, and introducing non-process gas to maintain the pressure in the processing chamber;

S34, adjusting the radio frequency source to be off, lifting the substrate, driving the heating tray to rotate at a set angle, and then placing the substrate back on the heating tray;

S35, introducing process gas into the processing chamber, and adjusting the radio frequency source to be on, and depositing a certain number of layers of thin films on the substrate;

S36, stopping to introduce the process gas and introducing non-process gas to maintain the pressure in the processing chamber;

S37, judging whether the number of layers of the deposited thin film on the substrate satisfies the set number of layers; if not, going back to step S32; if yes, executing step S38;

S38, taking out the substrate from the processing chamber.

17. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S41, placing a multiple of substrates in sequence in the processing chamber to complete the thin film deposition process;

S42, rotating the gas supply assembly by a set angle;

S43, cleaning the processing chamber, and going back to S41 after the processing chamber is purified.

18. A thin film deposition method using the thin film deposition device claimed in claim 1, comprising:

S51, placing multiple substrates in sequence in the processing chamber to complete the thin film deposition process;

S52, adjusting the gap between a second porous plate of a gas regulating unit and a first porous plate of a gas supply assembly;

S53, cleaning the processing chamber, and after the processing chamber is purified going back to step S51.

19. The thin film deposition method of claim 18, wherein the gap between the second porous plate and the first porous plate is adjusted by stretching or shrinking the side wall of the gas regulating unit in vertical direction.

20. The thin film deposition method of claim 18, wherein the gap between the second porous plate and the first porous plate is adjusted by stretching or shrinking the telescopic rod in the gas regulating unit along the vertical direction.

21. The thin film deposition method of claim 8, 14,16,17 or 18, wherein the thin film deposited on the substrate includes a first material and a second material deposited alternately.

22. The thin film deposition method of claim 21, wherein the first material is silicon oxide, and the second material is silicon nitride.