

CLAIMS

Claim 1:

A wafer transfer robot configured to transfer wafers in a cleaning module of a chemical mechanical planarization equipment, to take out the wafers that have been cleaned in a cleaning unit of the cleaning module in a vertical state, and to flip over and place them horizontally into a drying unit of the cleaning module, the wafer transfer robot comprising:

a horizontal transfer shaft only located on one side of the cleaning unit;

a horizontal transfer carriage that is arranged on the horizontal transfer shaft and is configured to move laterally along the horizontal transfer shaft;

a first vertical lifting shaft that is arranged on the horizontal transfer carriage and is configured to perform vertical movement on the horizontal transfer carriage;

a rotating table arranged on the first vertical lifting shaft;

a first jaw clamping arm which is connected to the rotating table and is configured to be driven by the rotating table to make rotational movement for wafer grabbing and placement,

wherein the cleaning unit includes a pre-drying unit and other units of the cleaning module, which are located on both sides of the pre-drying unit; the pre-drying unit is configured to work in a vertical direction; the wafers in the pre-drying unit are transferred to the drying unit by the first jaw clamping arm; preferably the other units of the cleaning module include one or more of wafer transition unit, megasonic cleaning unit, and scrubbing unit,

wherein the wafer transfer robot further comprises: at least one second vertical lifting shaft, which is arranged on the horizontal transfer carriage and is configured to perform vertical movement on the horizontal transfer carriage; the first vertical lifting

shaft is located between the second vertical lifting shaft and the drying unit; each of the second vertical lifting shafts is also provided with a second claw clamping arm that is configured to transfer wafers from the other units of the cleaning module to the pre-drying unit in combination with the first claw clamping arm.

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Claim 2:

The wafer transfer robot of claim 1 configured to transfer the wafers in the cleaning module of the chemical mechanical planarization equipment, to take out the wafers that have been cleaned in the cleaning unit of the cleaning module in the vertical state, and to flip over and place them horizontally into the drying unit of the cleaning module, wherein each of the cleaning unit and the drying unit is installed with switchable doors for automatic opening or closing when the wafer transfer robot grabs and places the wafers.

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Claim 3:

A wafer flipping method by a wafer transfer robot of claim 1, the method comprising performing a wafer placement and robot returning, wherein

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the wafer placement includes the following steps: after taking out a wafer from the pre-drying unit of the cleaning unit, the first jaw clamping arm performs interactive or non-interactive actions in three movement directions: horizontal, vertical, and rotation, flips the wafer from a vertical state to a horizontal state, and places it in the drying unit;

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the robot returning includes the following steps: after placing the wafer in the drying unit, the first jaw clamping arm restores from the horizontal state to the vertical state through interactive or non-interactive actions in three movement directions: horizontal, vertical, and rotation, and returns to an original position.

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Claim 4:

The wafer flipping method of claim 3, wherein the wafer placement includes the following steps:

after taking out the wafer from the pre-drying unit, the first jaw clamping arm moves
5 in the following three directions simultaneously: the horizontal transfer carriage drives the first jaw clamping arm to make transverse motion in a direction away from the drying unit; the rotating table drives the first jaw clamping arm to rotate to a side close to the drying unit until the wafer reaches the horizontal state, and the first vertical lifting shaft drives the first jaw clamping arm to move vertically to a certain position ;

10 then the horizontal transfer carriage drives the first jaw clamping arm to move laterally towards the drying unit until the wafer is positioned above the drying unit; the first vertical lifting shaft drives the first jaw clamping arm to move vertically downwards until the wafer is positioned on a designated mechanism inside the drying unit; the first jaw clamping arm releases the wafer so that the wafer is positioned on the designated mechanism inside the
15 drying unit.

Claim 5:

The wafer flipping method of claim 3, wherein the wafer placement specifically includes the following steps: after the first jaw clamping arm takes out the wafer from the
20 pre-drying unit, the horizontal transfer carriage drives the first jaw clamping arm to make transverse motion away from the drying unit; the rotating table drives the first jaw clamping arm to rotate to a side close to the drying unit until the wafer reaches the horizontal state, and the first vertical lifting shaft drives the first jaw clamping arm to move vertically to a certain position; then the horizontal transfer carriage drives the first jaw clamping arm to
25 move laterally towards the drying unit until the wafer is positioned above the drying unit;

the first vertical lifting shaft drives the first jaw clamping arm to move vertically downwards until the wafer is positioned on a designated mechanism inside the drying unit; the first jaw clamping arm releases the wafer so that the wafer is positioned on the designated mechanism inside the drying unit.

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Claim 6:

The wafer flipping method of claim 3, wherein the wafer placement specifically includes the following steps: after the first jaw clamping arm takes out the wafer from the pre-drying unit, the horizontal transfer carriage drives the first jaw clamping arm to make
10 transverse motion away from the drying unit; the rotating table drives the first jaw clamping arm to rotate to a side close to the drying unit until the wafer reaches the horizontal state, and then the horizontal transfer carriage drives the first jaw clamping arm to move laterally towards the drying unit until the wafer is positioned above the drying unit; the first vertical
lifting shaft drives the first jaw clamping arm to move vertically downwards until the wafer
15 is positioned on a designated mechanism inside the drying unit; the first jaw clamping arm releases the wafer so that the wafer is positioned on the designated mechanism inside the drying unit.

Claim 7:

20 The wafer flipping method of claim 3, wherein the wafer placement specifically includes the following steps: after the first jaw clamping arm takes out the wafer from the pre-drying unit, the rotating table drives the first jaw clamping arm to rotate to a side close to the drying unit until the wafer reaches the horizontal state, and then the horizontal transfer carriage drives the first jaw clamping arm to move laterally towards the drying unit until the
25 wafer is positioned above the drying unit; the first vertical lifting shaft drives the first jaw

clamping arm to move vertically downwards until the wafer is positioned on a designated mechanism inside the drying unit; the first jaw clamping arm releases the wafer so that the wafer is positioned on the designated mechanism inside the drying unit.

5 Claim 8:

The wafer flipping method of claim 3, wherein the robot returning specifically includes the following steps: the first jaw clamping arm moves in the following three directions simultaneously when the wafer is positioned at the drying unit: the horizontal transfer carriage drives the first jaw clamping arm to make transverse motion away from the drying
10 unit; the rotating table drives the first jaw clamping arm to rotate downward until the latter is in the vertical state, and the first vertical lifting shaft drives the first jaw clamping arm to move up vertically to a certain position.

Claim 9:

15 The wafer flipping method of claim 3, wherein the robot returning specifically includes the following steps: when the wafer is positioned at the drying unit, the first vertical lifting shaft drives the first jaw clamping arm to move up vertically to a certain position; the horizontal transfer carriage drives the first jaw clamping arm to make transverse motion to a certain position away from the drying unit; and then the rotating table drives the first jaw
20 clamping arm to rotate downward until the latter is in the vertical state.

Claim 10:

The wafer flipping method of claim 3, wherein the robot returning specifically includes the following steps: when the wafer is positioned at the drying unit, the horizontal transfer
25 carriage drives the first jaw clamping arm to make transverse motion to a certain position

away from the drying unit; the first vertical lifting shaft drives the first jaw clamping arm to move up vertically to a certain position; and then the rotating table drives the first jaw clamping arm to rotate downward until the latter is in the vertical state.