CLAIMS

WHAT IS CLAIMED IS:

1. A control circuit for semiconductor processing, and being configured to output a direct current (DC) signal in the form of a pulsed signal, comprising:

a switch circuit having a first terminal, a second terminal, a third terminal, a fourth terminal, a first control terminal, and a second control terminal, wherein the first terminal and the second terminal are input terminals of the DC signal, the third terminal and the fourth terminal are output terminals of the pulsed signal, the first control terminal and the second control terminal receive a first signal or a second signal to control outputting the pulsed signal, in response to the first control terminal and the second control terminal receiving the first signal, the third terminal and the fourth terminal output the pulsed signal, and in response to the first control terminal and the second control terminal receiving the second signal, the third terminal and the fourth terminal stop outputting the pulsed signal; and

an energy storage circuit having two terminals connected to the first terminal and the second terminal of the switch circuit to store residual electric energy of the switch circuit when the switch circuit does not output the pulsed signal, which is configured to improve accuracy of controlling plasma energy and density used in semiconductor processes.

2. The control circuit according to claim 1, wherein:

the switch circuit includes a first switch component and a second switch component;

a first terminal and a second terminal of the first switch component and a first terminal and a second terminal of the second switch component are used as input terminals for the DC signal;

the first terminal of the first switch component is connected to the first terminal of the energy storage circuit and the first terminal of the second switch component, respectively;

the second terminal of the first switch component is connected to the second terminal of the energy storage circuit and the second terminal of the second switch component, respectively;

a control terminal of the first switch component and a control terminal of the second switch component are configured to receive the first signal or the second signal;

a third terminal of the first switch component and a third terminal of the second switch component are used for outputting the pulsed signal;

in response to the control terminal of the first switch component receiving the first signal, the first switch component is configured to turn on a circuit between the first terminal of the first switch component and the third terminal of the first switch component, and to turn off a circuit between a second terminal of the energy storage circuit and the third terminal of the first switch component;

in response to the control terminal of the first switch component receiving the second signal, the first switch component is configured to turn off the circuit between the first terminal of the first switch component and the third terminal of the first switch component, and to turn on the circuit between the second terminal of the energy storage circuit and the third terminal of the first switch component;

in response to the control terminal of the second switch component receiving the first signal, the second switch component is configured to turn on a circuit between the second

terminal of the second switch component and the third terminal of the second switch component, and to turn off a circuit between a first terminal of the energy storage circuit and the third terminal of the second switch component; and

in response to the control terminal of the second switch component receiving the second signal, the second switch component is configured to turn off the circuit between the second terminal of the second switch component and the third terminal of the second switch component, and to turn on the circuit between the first terminal of the energy storage circuit and the third terminal of the second switch component.

3. The control circuit according to claim 2, wherein:

the first switch component includes a first switch transistor and a first cut-off diode;

an input terminal of the first switch transistor and an input terminal of the first cut-off diode are used as the input terminals for the DC signal;

the input terminal of the first switch transistor is connected to the first terminal of the energy storage circuit;

the input terminal of the first cut-off diode is connected to the second terminal of the energy storage circuit;

an output terminal of the first switch transistor is connected to an output terminal of the first cut-off diode for outputting the pulsed signal;

a control terminal of the first switch transistor is configured to receive the first signal or the second signal;

in response to the control terminal of the first switch transistor receiving the first signal, the first switch transistor is configured to turn on a circuit between the input terminal and the

output terminal of the first switch transistor, and the first cut-off diode is configured to turn off a circuit between the second terminal of the energy storage circuit and the output terminal of the first cut-off diode; and

in response to the control terminal of the first switch transistor receiving the second signal, the first switch transistor is configured to turn off the circuit between the input terminal and the output terminal of the first switch transistor, and the first cut-off diode is configured to turn on the circuit between the second terminal of the energy storage circuit and the output terminal of the first cut-off diode.

4. The control circuit according to claim 3, wherein:

material used for the first switch transistor includes any one of Si, SiC, GaN, and AlGaN.

5. The control circuit according to claim 2, wherein:

the second switch component includes a second switch transistor and a second cut-off diode;

an input terminal of the second switch transistor is connected to an input terminal of the first cut-off diode for outputting the pulsed signal;

an output terminal of the second switch transistor and an output terminal of the second cut-off diode are used as the input terminals for the DC signal;

the output terminal of the second switch transistor is connected to the second terminal of the energy storage circuit;

the output terminal of the second cut-off diode is connected to the first terminal of the energy storage circuit;

a control terminal of the second switch transistor is configured to receive the first signal or the second signal;

in response to the control terminal of the second switch transistor receiving the first signal, the second switch transistor is configured to turn on a circuit between the input terminal and the output terminal of the second switch transistor, and the second cut-off diode is configured to turn off a circuit between the first terminal of the energy storage circuit and the output terminal of the second cut-off diode; and

in response to the control terminal of the second switch transistor receiving the second signal, the second switch transistor is configured to turn off the circuit between the input terminal and the output terminal of the second switch transistor, and the second cut-off diode is configured to turn on the circuit between the first terminal of the energy storage circuit and the output terminal of the second cut-off diode.

6. The control circuit according to claim 5, wherein:

material used for the second switch transistor includes any one of Si, SiC, GaN, and AlGaN.

7. The control circuit according to claim 1, wherein:

the energy storage circuit includes at least one capacitor and/or at least one inductor;

one terminal of the at least one capacitor and/or the at least one inductor is used as the first terminal of the energy storage circuit to connect to the first terminal of the switch circuit; and

another terminal of the at least one capacitor and/or the at least one inductor is used as the second terminal of the energy storage circuit to connect to the second terminal of the switch circuit.

8. The control circuit according to claim 1, further comprising:

a transformer including a primary inductor and a secondary inductor, wherein two terminals of the primary inductor are connected to the third terminal and the fourth terminal of the switch circuit, respectively, and two terminals of the secondary inductor are configured to output the pulsed signal.

9. The control circuit according to claim 1, further comprising:

a control component configured to send the first signal or the second signal to the first control terminal and the second control terminal of the switch circuit.

10. A pulsed power supply system, comprising a DC circuit and the control circuit according to any of claims 1-9, wherein the DC circuit is configured to supply the DC signal to the first terminal and the second terminal of the switch circuit.

11. The pulsed power supply system according to claim 10, wherein the DC circuit includes a DC power supply.

12. Semiconductor processing equipment, comprising:

an upper electrode assembly;

a lower electrode assembly; and

at least one pulsed power supply system according to any of claims 10-11, configured to supply the pulsed signal to at least one of the upper electrode assembly or the lower electrode assembly.

13. The semiconductor processing equipment according to claim 12, wherein:

the semiconductor processing equipment includes plasma immersion implantation equipment, physical vapor deposition equipment, or plasma etching equipment.