WHAT IS CLAIMED IS:

1. A substrate processing apparatus, comprising:

a reaction container configured to process a substrate;

a cleaning gas supply system configured to supply a cleaning gas into the reaction container;

a lid configured to be capable of closing an opening of the reaction container and made of a metallic material;

a protector installed over a surface of the lid at a side facing an inside of the reaction container and including a surface made of a first non-metallic material;

a first seal installed between the lid and the protector along an outer periphery of the protector and configured to seal a gap between the lid and the protector with a first gasket;

an internal space including a space surrounded by surfaces of the lid and the protector facing each other, and surrounded by the first seal; and

an inert gas supply system configured to supply an inert gas to the internal space in a state in which the opening is closed by the lid,

wherein the first seal is configured to seal the internal space so that the inert gas supplied to the internal space flows into the reaction container through at least one selected from the group of a gap between the first gasket and the protector and a gap between the first gasket and the lid.

2. The apparatus of Claim 1, wherein at least one selected from the group of the lid and the protector includes the first seal.

3. The apparatus of Claim 2, wherein the first seal is installed over an entire circumference of at least one selected from the group of the lid and the protector.

4. The apparatus any one of Claims 1 to 3, wherein the protector includes one or more through-holes formed at an outer peripheral end of the protector to bring the internal space and a space in the reaction container into communication with each other.

5. The apparatus any one of Claims 1 to 4, wherein the inert gas supply system is configured to supply the inert gas to the internal space through a first gas supply port installed on the surface of the lid facing the internal space.

6. The apparatus of Claim 5, wherein the lid includes:

a gas introduction port installed at a contact surface in contact with an opening end of the reaction container; and

a gas flow path configured to connect the gas introduction port and the first gas supply port to communicate with each other,

wherein the reaction container includes a second gas supply port installed at the contact surface in contact with the lid, and

wherein the second gas supply port and the gas introduction port are arranged so that the second gas supply port and the gas introduction port communicate with each other in the state in which the opening of the reaction container is closed.

7. The apparatus of Claim 6, wherein at least one selected from the group of the lid and the opening end includes a groove installed along an outer periphery of the lid facing the contact surface, and

wherein the second gas supply port is connected to the gas introduction port via the groove in the state in which the opening is closed by the lid.

8. The apparatus of Claim 7, wherein at least one selected from the group of the lid and the opening end includes a second seal installed along the outer periphery of the lid and configured

to seal the contact surface by a second gasket in the state in which the opening is closed by the lid, and

wherein the groove is installed inside the second seal when viewed from a center of the reaction container.

9. The apparatus of Claim 8, wherein a gap is installed between the lid and the opening end of the reaction container to bring the groove and a space in the reaction container into communication with each other in the state in which the opening is closed by the lid.

10. The apparatus of Claim 9, wherein the protector is installed so that an outer peripheral end of the protector is located outside an inner periphery of the opening end when viewed from the center of the reaction container, in the state in which the opening is closed by the lid.

11. The apparatus any one of Claims 1 to 10, wherein an opening end of the reaction container is provided by a manifold.

12. The apparatus any one of Claims 1 to 11, wherein the protector is secured to the lid by at least one selected from the group of a screw and a bolt.

13. The apparatus of Claim 12, wherein the screw is made of a second non-metallic material.

14. The apparatus any one of Claims 1 to 13, further comprising:

a controller configured to be capable of controlling the cleaning gas supply system and the inert gas supply system to supply the inert gas from the inert gas supply system into the internal space while supplying the cleaning gas into the reaction container from the cleaning gas supply system.

15. The apparatus of Claim 14, further comprising:

an exhaust system configured to exhaust the inside of the reaction container,

wherein the controller is configured to be capable of controlling the cleaning gas supply system, the inert gas supply system, and the exhaust system so that a pressure in the internal space is higher than a pressure in the reaction container to which the cleaning gas is supplied.

16. The apparatus any one of Claims 1 to 15, further comprising:

a refrigerant flow path installed inside the lid or on a lower surface of the lid.

17. The apparatus any one of Claims 1 to 16, wherein the protector is made of at least one selected from the group of quartz and silicon carbide.

18. The apparatus any one of Claims 1 to 16, wherein the protector is made of a metallic material whose surface is coated with the first non-metallic material.

19. A cleaning method, comprising:

closing an opening of a reaction container configured to process a substrate, with a lid made of a metallic material;

supplying an inert gas to an internal space formed between surfaces of the lid and a protector facing each other, the protector installed over a surface of the lid at a side facing an inside of the reaction container and including a surface composed of a first non-metallic material, in a state in which the opening is closed by the lid; and

supplying a cleaning gas into the reaction container in a state in which the inert gas is supplied to the internal space,

wherein a first seal configured to seal a gap between the lid and the protector with a first gasket is installed between the lid and the protector along an outer periphery of the protector,

wherein the internal space includes a space surrounded by the surfaces of the lid and the protector facing each other, and surrounded by the first seal, and

wherein the first seal is configured to seal the internal space so that the inert gas supplied to the internal space flows into the reaction container through at least one selected from the group of a gap between the first gasket and the protector and a gap between the first gasket and the lid.

20. A method of manufacturing a semiconductor device, comprising:

forming a film on a substrate by supplying a film-forming gas into a reaction container in which the substrate is accommodated;

unloading the substrate on which the film is formed from an inside of the reaction container; and

performing the cleaning method of Claim 19 after the substrate is unloaded from the inside of the reaction container.

21. A program that causes, by a computer, a substrate processing apparatus to perform a process, the process comprising:

closing an opening of a reaction container configured to process a substrate, with a lid made of a metallic material;

supplying an inert gas to an internal space formed between surfaces of the lid and a protector facing each other, the protector installed over a surface of the lid at a side facing an inside of the reaction container and including a surface composed of a first non-metallic material, in a state in which the opening is closed by the lid; and

supplying a cleaning gas into the reaction container in a state in which the inert gas is supplied to the internal space,

wherein a first seal configured to seal a gap between the lid and the protector with a first gasket is installed between the lid and the protector along an outer periphery of the protector,

wherein the internal space includes a space surrounded by the surfaces of the lid and the protector facing each other, and surrounded by the first seal, and

wherein the first seal is configured to seal the internal space so that the inert gas supplied to the internal space flows into the reaction container through at least one selected from the group of a gap between the first gasket and the protector and a gap between the first gasket and the lid.

22. The apparatus of Claim 1, further comprising:

a controller configured to be capable of controlling the inert gas supply system to supply the inert gas to the internal space so that a pressure in the internal space becomes a predetermined pressure at which the inert gas supplied to the internal space flows into the reaction container through at least one selected from the group of the gap between the first gasket and the protector and the gap between the first gasket and the lid.

23. The apparatus of Claim 22, further comprising:

a pressure detector configured to detect the pressure in the internal space,

wherein the inert gas supply system is configured to be controlled based on the pressure detected by the pressure detector so that the pressure in the internal space becomes the predetermined pressure.