

CLAIMS

1. A gas supply apparatus that supplies gas to a processing chamber in which a sample is processed, the gas supply apparatus comprising:
 - ports respectively connected to gas sources of a plurality of types of gases containing a purging gas and a processing gas; and
 - a collective pipe in which the plurality of types of gases supplied from the ports are joined and flowed, wherein
 - a gas flow path through which gas supplied from the port connected to the gas source for the purging gas flows is formed on an uppermost stream side of the collective pipe, and wherein
 - an uppermost stream gas valve that flows out the purging gas is arranged in a direction flowing out a flow-controlled purge gas from a diaphragm side to an anti-diaphragm side by an opening operation of a diaphragm, and a gas contact portion when the processing gas flows out to the collective pipe is limited to a central pressing part of the diaphragm and an uppermost stream end of the collective pipe does not have a dead volume.
2. The gas supply apparatus according to claim 1, wherein
 - a three-way valve configured to perform opening and closing operations by a diaphragm is arranged on the collective pipe,
 - the three-way valve forms the collective pipe itself in a diaphragm-side gas flow path through which gas can pass without cutting off a gas flow, and
 - the processing gas to be flowed out by an opening operation of the diaphragm of the three-way valve is configured to be joined in the collective pipe.
3. The gas supply apparatus according to claim 1, wherein
 - the gas supply apparatus further comprises separately a three-way valve

configured to perform opening and closing operations by a diaphragm, a flow rate controller for the processing gas, and a flow rate controller for a dilution gas diluting the processing gas, and

to control a flow rate of the processing gas, a gas flow path through which the dilution gas can pass without cutting off a gas flow is formed on a diaphragm side of the three-way valve and the processing gas is flowed out by an opening operation of the diaphragm of the three-way valve to be joined into the gas flow path through which the dilution gas can pass.

4. The gas supply apparatus according to claim 3, wherein a gas valve downstream of the flow rate controller flowing out the dilution gas is arranged in a direction flowing out a flow-controlled dilution gas from a diaphragm side to an anti-diaphragm side, and a gas contact portion of the process gas joined into the gas flow path is limited to a central pressing part of the diaphragm and an uppermost stream end of the gas flow path does not have a dead volume.

5. The gas supply apparatus according to claim 1, wherein the collective pipe is separately provided with a first gas line configured to supply the purging gas and the processing gas to the processing chamber and a second gas line configured to exhaust the purging gas and the processing gas.

6. The gas supply apparatus according to claim 1, wherein gas supply blocks are formed for respective types of gases that cannot be mixed inside the common collective pipe and inside a common supply pipe configured to supply gas, and the collective pipe is provided for each of the gas supply blocks.

7. A vacuum processing apparatus comprising:
a gas supply apparatus according to claim 1; and

a processing chamber that is supplied with gas from the gas supply apparatus.

8. A gas supply method using a gas supply apparatus according to claim 6, the method comprising:

during processing the sample, constantly flowing a purging gas from an upstream side of the collective pipe on a supply side to the processing chamber of all the gas supply blocks; and processing a predetermined processing gas in accordance with a progress status of each processing step while selecting a gas type to be used by opening and closing of valves for processing gases forming the collective pipe to allow gas to constantly flow in a supply pipe connected to the processing chamber of any gas supply block.

9. A gas supply method using the gas supply apparatus according to claim 6, the method comprising:

when intermittently supplying gas to the processing chamber in the gas supply block, alternately opening and closing valves arranged in the collective pipe connected to a supply pipe leading to the processing chamber or valves arranged in the collective pipe connected to an exhaust system for waste gas while constantly performing gas flow control by flow rate controllers of the purging gas and a type of gas to be used to perform intermittent supply of the gas to the processing chamber; and flowing the purging gas onto a supply pipe side different from the supply pipe of the gas from a valve for the purging gas arranged on an uppermost stream side of the collective pipe to constantly flow the gases in both the collective pipes and both the supply pipes.

10. The gas supply method according to claim 9, further comprising:
when there are two or more gas supply blocks configured to intermittently

supply processing gases, prohibiting simultaneous opening and closing of supply valves for the processing gas forming the collective pipe so that the processing gases respectively supplied from the gas supply blocks are not simultaneously supplied to the processing chamber or the exhaust system.

11. A gas supply method using the gas supply apparatus according to claim 1, the method comprising:

flowing out the processing gas in a middle of the collective pipe while supplying the purging gas from an uppermost stream side of the collective pipe.

12. A gas supply method using the gas supply apparatus according to claim 1, the method comprising:

stopping supplying the processing gas after processing the sample and simultaneously flowing the purging gas to an exhaust system and a supply pipe that supplies the purging gas to the processing chamber.