WHAT IS CLAIMED IS:

1. A system for processing articles comprising:

a fluid supply;

an apparatus for controlling flow fluidly coupled to the fluid supply, the apparatus for controlling flow comprising:

a body comprising a flow path extending from an inlet to an outlet;

a valve operably coupled to the flow path between the inlet and the outlet, the valve configured to alter fluid flow within the flow path, the valve comprising a seat and a closure member;

a flow restrictor having a flow impedance located within the flow path; and

a pressure sensor configured to measure pressure within a volume between the seat of the valve and the flow restrictor; and

a processing chamber fluidly coupled to the outlet of the apparatus for controlling flow, the processing chamber configured to process semiconductor devices.

2. The system of claim 1 wherein the valve is located between the inlet and the flow restrictor.

3. The system of claim 1 wherein the valve is located between the flow restrictor and the outlet.

4. The system of claim 1 wherein the valve is a proportional valve.

5. The system of any one of claims 1 to 4 wherein the valve comprises a first actuator and a second actuator, the first actuator being a pneumatic actuator and the second actuator being a piezoelectric actuator; wherein the valve transitions from a closed state where the closure member is in contact with the valve seat to an open state where the closure member is spaced from the valve seat, the valve biased into the closed state by a biasing element; and wherein the first actuator is configured to transition between an inactive state and an active state, the first actuator applying a first force against the biasing element in the active state.

6. The system of claim 5 wherein the valve transitions from the closed state to the open state upon the first actuator being placed in an active state.

7. The system of claim 5 wherein, in the open state, a distance between the closure member and the valve seat varies based whether the first actuator is in an active state or an inactive state.

8. The system of any one of claims 1 to 4 wherein the valve comprises an actuator, the actuator being a piezoelectric actuator; wherein the valve transitions from a closed state where the closure member is in contact with the valve seat to an open state where the closure member is spaced from the valve seat, the valve biased into the closed state by a biasing element; and wherein the actuator is configured to transition between an inactive state and an active state, the actuator applying a force against the biasing element in the active state.

9. The system of any one of claims 1 to 4 wherein the valve comprises an actuator, the valve transitioning from an open state where the closure member is spaced from the valve seat to a closed state where the closure member is in contact with the valve seat; wherein the actuator is configured to transition between an inactive state and an active state, the actuator applying a force to reduce a distance between the closure member and the valve seat when the actuator is in an active state; wherein the distance is maximized when the actuator is in an inactive state; and wherein, in the active state, a distance between the closure member and the valve seat varies based on a drive voltage applied to the actuator.

10. The system of any one of claims 1 to 4 wherein the valve comprises:

a button engaging the closure member;

a plunger engaging the button;

a plurality of transmission pins in contact with the plunger;

a piston engaging the plurality of transmission pins; and

a biasing element engaging the piston.

11. The system of claim 10 wherein the piston forms a portion of a chamber of a first actuator.

12. The system of claim 10 wherein a second actuator nests within the piston.

13. The system of any one of claims 1 to 4 wherein the valve comprises:
a button engaging the closure member;
a piston engaging the button;
a piezoelectric actuator engaging the piston; and
a biasing element engaging the piston.

14. The system of claim 13 wherein the piston forms a portion of a chamber of a first actuator and the piezoelectric actuator is a second actuator; wherein transitioning the first actuator from an inactive state to an active state moves the valve from a closed state to an open state; and wherein, when the second actuator is in an inactive state and the first actuator is in the active state, the valve seat and the closure member are separated by a first distance and when the second actuator is in an active state and the first actuator is in the active state, the valve seat and the closure member are separated by a second distance that is less than the first distance.

15. The system of any one of claims 1 to 4 wherein the apparatus for controlling flow is configured to transition from a first state where no fluid exits the outlet to a second state where fluid is delivered from the outlet at a substantially constant mass flow rate, a position of the valve driven in an open loop control mode during a transition period between the first and second states; and wherein the position of the valve is driven in a closed loop control mode subsequent to the transition period.

16. A method for processing semiconductors comprising:

supplying a fluid to an apparatus for controlling flow, the apparatus for controlling flow comprising a body, a valve, a flow restrictor, and a pressure sensor, the body comprising a flow path extending from an inlet to an outlet, the valve located within the flow path and comprising a seat, a closure member, an actuator configured to control a position of the closure member relative to the seat, the flow restrictor located within the flow path, and the pressure sensor configured to sense a pressure within a volume between the seat of the valve and the flow restrictor, the valve in a closed state preventing the fluid from flowing out of the outlet;

receiving a command from a controller to flow the fluid at a predetermined flow rate;

transitioning the actuator to an active state to control the position of the closure member in a first operating mode, the position corresponding to the predetermined flow rate;

controlling the actuator in a second operating mode wherein the actuator is controlled based on feedback from the pressure sensor.

17. The method of claim 16 wherein, in the step of transitioning, the first operating mode is an open loop control mode.

18. The method of claim 16 or claim 17 wherein, in the step of transitioning, the predetermined flow rate corresponds to a position setpoint, the position of the valve driven to the position setpoint; and wherein, in the step of controlling, the second operating mode is a closed loop control mode.

19. An apparatus for controlling flow comprising:

a body comprising a flow path extending from an inlet to an outlet;

a valve operably coupled to the flow path between the inlet and the outlet, the valve configured to alter fluid flow within the flow path, the valve comprising:

a seat;

a closure member configured to engage the seat;

an actuator configured to control a distance between the closure member and the seat; and

an adjustment means configured to adjust a pre-load between the closure member and the seat;

a flow restrictor having a flow impedance located within the flow path; and

a pressure sensor configured to measure pressure within a volume between the seat of the valve and the flow restrictor;

wherein, when the valve is in a closed state, the pre-load is applied to compress the closure member against the seat, the pre-load being adjustable from a first force wherein the apparatus has a first maximum flow rate to a second force wherein the apparatus has a second maximum flow rate, the second force being greater than the first force and the second maximum flow rate being less than the first maximum flow rate.

20. The apparatus of claim 19 wherein a maximum distance between the closure member and the seat is greater for the first force than the second force.