What is claimed is:

1. A system for delivering pulses of a desired mass of gas to a tool as a complete recipe of mass flows, the system comprising:

a mass flow controller including a flow sensor, an adjustable control valve and a dedicated controller, wherein, prior to delivery of the complete recipe of mass flows that defines mass flows to be controlled by the adjustable control valve during each of the pulses, the dedicated controller is configured to receive the complete recipe including a sequence of steps for opening and closing the adjustable control valve repeatedly so as to deliver a sequence of gas pulses as a function of the recipe, wherein the complete recipe includes a sequence of a number of pulses of gas delivered for a particular gas at a particular step in a semiconductor fabrication process, and wherein the dedicated controller is operative to, in response to a trigger signal, open and close the adjustable control valve repeatedly and, using feedback control from the flow sensor, tune the flow through the adjustable control valve while the control valve is open and thereby deliver mass flow according to all of the steps of the complete recipe.

2. A system according to claim 1, further including a host controller, wherein the host controller provides the trigger signal.

3. A system according to claim 2, wherein the host controller is configured and arranged to upload the recipe to the dedicated controller.

4. A system according to claim 2, further including a plurality of said mass flow controllers for delivery of a plurality of sets of pulses of gas in response to a plurality of trigger signals, respectively.

5. A system according to claim 4, wherein the host controller is configured to stagger the trigger signals to a plurality of said mass flow controllers so that the pulse delivery of these devices are in time-multiplexed way.

6. A system according to claim 1, wherein the mass flow controller operates in one of at least two modes of operation.

7. A system according to claim 6, wherein in one of the modes the mass flow controller is configured and arranged so as to operate as a traditional mass flow controller (MFC) mode receiving flow set point signals as a part of said recipe so as to control the flow rate of gas delivered to a processing tool.

8. A system according to claim 6, wherein in one of the modes the mass flow controller is configured and arranged so as to operate in a pulse gas delivery (PGD) mode.

9. A system according to claim 8, wherein in the PGD mode the mass flow controller is configured and arranged so as to receive a pulse profile and the necessary sequencing of pulses so that the mass flow controller can deliver a gas from a supply to a process tool in accordance with a recipe including a profile and sequence of timed pulses provided by a user.

10. A system according to claim 9, wherein the dedicated controller is programmed with the profile and sequencing of the pulses in response to information downloaded or configured from a host controller to the dedicated controller.

11. A system according to claim 10, wherein the information downloaded or configured from the host controller to the dedicated controller allows the mass flow controller to carry out all of the sequencing steps in response to a single trigger signal received from the host controller.

12. A system according to claim 1, wherein the dedicated controller is configured and arranged so as to carry any one of at least three different types of pulse gas delivery processes.

13. A system according to claim 12, wherein the three different types of pulse gas delivery processes include a time based delivery process, a mole based delivery process and a profile based delivery process.

14. A system according to claim 1, wherein when configured to deliver gas in accordance with a time based delivery process, the dedicated controller is configured and arranged by the user to include the following parameters for the time based delivery process: (1) at least one targeted flow set point (Q_{sp}), (2) at least one time length of the pulse-on period (T_{on}), (3) at least one time length of each pulse-off period (T_{off}), and (4) the total number of pulses (N) required to complete the whole pulse gas delivery process.

15. A system according to claim 1, wherein the dedicated controller is configured and arranged by the user to include the following parameters for a mole based delivery process: (1) at least one mole delivery set point (n_{sp}), (2) at least one target time length of pulse-on period (T_{on}), (3) at least one time length of total pulse on and off period (T_{total}), and (3) the number of pulses (N) to be delivered, so that the dedicated controller is configured and arranged so as to automatically adjust the mole delivery set point and the pulse-on period so as to precisely deliver within the targeted pulse-on period the targeted mole amount of gas based on measurements taken by the flow sensor and the feedback of previous delivery amounts.

16. A system according to claim 1, wherein the dedicated controller is configured to control flow through the adjustable control valve for mole based delivery wherein gas is delivered in accordance with the following equation:

$$\Delta n = \int_{t1}^{t2} Q \cdot dt$$

wherein Δn is the number of moles of gas delivered during a pulse-on period (between times t1 and t2); and Q is the flow rate measured by the flow sensor during the pulse-on period.

17. A system according to claim 1, wherein when configured to deliver gas in accordance with a profile based delivery process, the dedicated controller is configured and arranged by a user to include a set of parameters for each pulse of the profile based delivery process depending on the type of process being run.

18. A system according to claim 1, wherein when configured to deliver gas in accordance with a profile based delivery process, the dedicated controller is configured and arranged by a user to include the following parameters for each pulse of the profile based delivery process: (1) the flow set point Q_{sp1} and a corresponding first pulse on and off period (T_{on1} T_{off1}), (2) the flow set point Q_{sp2} and a corresponding second pulse on and off period (T_{on2} T_{off2}), . . . (m) the flow set point Q_{spm} and a corresponding m-th pulse on and off period (T_{onm} T_{offm}), such that a set of parameters is provided for each pulse of the entire set of pulses, allowing the pulses to vary depending on the type of process being run.

19. A system according to claim 1, wherein when configured to deliver gas in accordance with a profile based delivery process, the dedicated controller is configured and arranged by a user to include the following parameters for each pulse of the profile based delivery process: (1) the mole delivery set point (n_{sp1}) and a corresponding first pulse on and off period (T_{on1} T_{off1}), (2) the mole delivery set point (n_{sp2})and a corresponding second pulse on and off period (T_{on2} T_{off2}), . . . (m) the mole delivery set point (n_{spm})and a corresponding m-th pulse on and off period (T_{onm} T_{offm}).