CLAIMS

1. A system for semiconductor processing, the system comprising:

a first source configured to supply a first liquid precursor;

a first ampoule configured to receive the first liquid precursor from the first source;

a first valve configured to adjust flow of the first liquid precursor from the first source to the first ampoule;

a second valve configured to adjust flow of a first precursor vapor from the first ampoule to a showerhead of a substrate processing chamber;

a first line charge volume container connected to a conduit and configured to store a charge of the first precursor vapor, wherein the conduit extends from the first ampoule to the second valve;

a third valve configured to adjust flow of a second process gas to the substrate processing chamber;

a second source configured to supply the second process gas; and

a generator configured to generate a radio frequency signal; and

a controller configured to:

open the first valve and close the second valve to precharge the first line charge volume container,

during at least a portion of a deposition operation, open the second valve to dispense a bulk amount of the first precursor vapor from the first line charge volume container and into the substrate processing chamber, and

after at least the portion of the deposition operation:

decrease flow of the first precursor vapor to the showerhead,

purge the substrate processing chamber,

supply the second process gas to the substrate processing chamber, and

control operation of the generator to supply the radio frequency signal to the showerhead.

2. The system of claim 1, wherein the controller is configured to precharge the first line charge volume container while performing other operations.

3. The system of claim 1, wherein the controller is configured to precharge the first line charge volume container while performing at least the portion of the deposition operation including discharging a second line charge volume container.

4. The system of claim 1, further comprising:

a third source configured to supply a second liquid precursor;

a second ampoule configured to receive the second liquid precursor from the third source; and

a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule,

wherein the controller is configured to

open the fourth valve and close the second valve to precharge the first line charge volume container with a second precursor vapor from the second ampoule concurrently with the first precursor vapor, and

during at least the portion of the deposition operation, open the second valve to dispense a bulk amount of the first precursor vapor and the second precursor vapor from the first line charge volume container and into the substrate processing chamber.

5. The system of claim 1, further comprising:

a third source configured to supply a second liquid precursor;

a second ampoule configured to receive the second liquid precursor from the third source;

a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule; and

a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead,

wherein the controller is configured to

open the fourth valve and close the fifth valve to precharge the first line charge volume container with the second precursor vapor, and

during at least a portion of another deposition operation subsequent to at least the portion of the deposition operation, open the fifth valve to dispense a bulk amount of the second precursor vapor from the first line charge volume container and into the substrate processing chamber.

6. The system of claim 1, further comprising:

a third source configured to supply a second liquid precursor;

a second ampoule configured to receive the second liquid precursor from the third source;

a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead; and

a second line charge volume container connected to a second conduit, wherein the second conduit extends from the second ampoule to the second valve and stores a charge of the second precursor vapor,

wherein the controller is configured to

open the fourth valve and close the fifth valve to precharge the second line charge volume container with the second precursor vapor, and

during at least a portion of another deposition operation subsequent to at least the portion of the deposition operation, open the fifth valve to dispense a bulk amount of the second precursor vapor from the second line charge volume container and into the substrate processing chamber.

7. The system of claim 1, further comprising:

a third source configured to supply a second liquid precursor;

a second ampoule configured to receive the second liquid precursor from the third source;

a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead; and

a second line charge volume container connected to a second conduit, wherein the second conduit extends from the second ampoule to the second valve and stores a charge of the second precursor vapor,

wherein the controller is configured to

open the fourth valve and close the fifth valve to precharge the second line charge volume container with the second precursor vapor, and

during at least the portion of the deposition operation, open the fifth valve to dispense a bulk amount of the second precursor vapor from the second line charge volume container and into the substrate processing chamber.

8. The system of claim 1, further comprising:

a third source configured to supply a carrier gas; and

a fourth valve configured to adjust flow of the carrier gas from the third source to the first ampoule,

wherein the controller is configured to, during at least the portion of the deposition operation, flow the carrier gas across the first liquid precursor in the first ampoule to entrain the first precursor vapor to flow into the showerhead.

9. The system of claim 1, wherein the controller is configured to, during at least the portion of the deposition operation, refrain from flowing a carrier gas across the first liquid precursor.

10. The system of claim 1, wherein the controller is configured to maintain the first valve at least partially open during at least the portion of the deposition operation.

11. The system of claim 1, wherein the controller is configured to close the first valve prior to or during at least the portion of the deposition operation.

12. The system of claim 1, further comprising a fourth valve configured to divert a portion of the first precursor vapor from being received by the showerhead,

wherein the controller is configured to control the fourth valve to divert excess of the first precursor vapor away from the showerhead.

13. The system of claim 1, wherein the controller is configured to precharge the first line charge volume container while supplying the second process gas to the substrate processing chamber.

14. A deposition method comprising:

receiving a first liquid precursor from a first source at a first ampoule;

providing a first valve to adjust flow of the first liquid precursor from the first source to the first ampoule;

providing a second valve to adjust flow of a first precursor vapor from the first ampoule to a showerhead of a substrate processing chamber;

opening the first valve and closing the second valve to precharge a first line charge volume container, wherein the first line charge volume container is connected to a conduit and configured to store a charge of the first precursor vapor, and wherein the conduit extends from the first ampoule to the second valve; and

during at least a portion of a deposition operation, opening the second valve to dispense a bulk amount of the first precursor vapor from the first line charge volume container and into the substrate processing chamber;

providing a third valve configured to adjust flow of a second process gas to the substrate processing chamber;

generating a radio frequency signal; and

subsequent the at least a portion of a deposition operation,

decreasing flow of the first precursor vapor to the showerhead,

purging the substrate processing chamber,

supplying the second process gas from a second source to the substrate processing chamber, and

supplying the radio frequency signal to the showerhead.

15. The deposition method of claim 14, further comprising precharging the first line charge volume container while performing other operations.

16. The deposition method of claim 14, further comprising precharging the first line charge volume container while performing at least a portion of another deposition operation for a second line charge volume container.

17. The deposition method of claim 14, further comprising:

receiving a second liquid precursor from a third source at a second ampoule;

providing a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

opening the fourth valve and closing the second valve to precharge the first line charge volume container with a second precursor vapor from the second ampoule concurrently with the first precursor vapor; and

during at least the portion of the deposition operation, opening the second valve to dispense a bulk amount of the first precursor vapor and the second precursor vapor from the first line charge volume container and into the substrate processing chamber.

18. The deposition method of claim 14, further comprising:

receiving at a second ampoule a second liquid precursor from a third source;

providing a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

providing a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead;

opening the fourth valve and closing the fifth valve to precharge the first line charge volume container with the second precursor vapor; and

during at least a portion of another deposition dose operation subsequent to at least the portion of the deposition operation, opening the fifth valve to dispense a bulk amount of the second precursor vapor from the first line charge volume container and into the substrate processing chamber.

19. The deposition method of claim 14, further comprising:

receiving at a second ampoule a second liquid precursor from a third source;

providing a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

providing a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead;

opening the fourth valve and closing the fifth valve to precharge a second line charge volume container with the second precursor vapor, wherein the second line charge volume container connected to a second conduit, and wherein the second conduit extends from the second ampoule to the second valve and stores a charge of the second precursor vapor; and

during at least a portion of another deposition operation subsequent to at least the portion of the deposition operation, opening the fifth valve to dispense a bulk amount of the second precursor vapor from the second line charge volume container and into the substrate processing chamber.

20. The deposition method of claim 14, further comprising:

receiving at a second ampoule a second liquid precursor from a third source;

providing a fourth valve configured to adjust flow of the second liquid precursor from the third source to the second ampoule;

providing a fifth valve configured to adjust flow of a second precursor vapor from the second ampoule to the showerhead; and

opening the fourth valve and closing the fifth valve to precharge a second line charge volume container with the second precursor vapor, wherein the second line charge volume container connected to a second conduit, and wherein the second conduit extends from the second ampoule to the second valve and stores a charge of the second precursor vapor,

wherein, during the at least the portion of the deposition operation, opening the fifth valve to dispense a bulk amount of the second precursor vapor from the second line charge volume container and into the substrate processing chamber.

21. The deposition method of claim 14, further comprising:

providing a fourth valve configured to adjust flow of a carrier gas received from a third source to the first ampoule; and

during the at least the portion of the deposition operation, flowing the carrier gas across the first liquid precursor in the first ampoule to entrain the first precursor vapor to flow into the showerhead.

22. The deposition method of claim 14, further comprising, during the at least the portion of the deposition operation, refraining from flowing a carrier gas across the first liquid precursor.

23. The deposition method of claim 14, further comprising maintaining the first valve at least partially open during at least the portion of the deposition operation.

24. The deposition method of claim 14, further comprising closing the first valve prior to or during at least the portion of the deposition operation.

25. The deposition method of claim 14, further comprising:

providing a fourth valve configured to divert a portion of the first precursor vapor from being received by the showerhead; and

controlling the fourth valve to divert excess of the first precursor vapor away from the showerhead.

26. The deposition method of claim 14, further comprising precharging the first line charge volume container while supplying the second process gas to the substrate processing chamber.