CLAIMS

I/we claim,

1. A deposition system, comprising:

a reaction chamber;

a plurality of precursor traps in fluid communication with the reaction chamber; the precursor traps being configured to trap precursor under a first condition, and to release the trapped precursor under a second condition;

a flow path along which precursor is flowed to the chamber, through the chamber, and from the chamber; and

wherein at least two of the precursor traps are connected in parallel relative to one another along the flow path so that one of said at least two of the precursor traps may be used as a source of precursor for reactions in the chamber while another of the at least two of the precursor traps is utilized for collecting unreacted precursor exiting from the chamber.

2. The system of claim 1 being configured for utilization in an ALD process.

3. The system of claim 1 being configured for utilization in a CVD process.

4. The system of claim 1 wherein the first and second conditions differ in temperature from one another.

5. An ALD system, comprising:

a reaction chamber;

a pair of alternate flow paths for materials exhausted from the reaction chamber, both of the alternate flow paths leading to a common main pump; a first of said alternate flow paths comprising a precursor trap configured to collect unreacted precursor; a second of said alternate flow paths by-passing the precursor trap; and

at least one flow control structure along said second of the alternate flow paths and configured to preclude back-flow along said second of the alternate flow paths.

6. The ALD system of claim 5 wherein the at least one flow control structure comprises a turbopump, destruct unit, or a cryopump.

7. The ALD system of claim 5 wherein the at least one flow control structure comprises a check-valve.

8. A CVD system, comprising:

a reaction chamber;

a flow path for a mixture of materials exhausted from the reaction chamber, the mixture of materials comprising one or more unreacted precursors; and

at least one precursor trap along the flow path and configured to selectively trap at least one of the one or more unreacted precursors relative to other components of the mixture of materials.

9. The CVD system of claim 8 wherein the precursor trap is a cold trap.

10. The CVD system of claim 8 comprising multiple precursor traps arranged in series along the flow path, the multiple precursor traps being configured to trap different precursor compositions relative to one another.

11. A deposition method, comprising:

flowing precursor through a reaction chamber; the precursor being flowed along a flow path; the flow path extending from upstream of the reaction chamber to the reaction chamber, and from the reaction chamber to downstream of the reaction chamber; some of the precursor reacting while in the reaction chamber, and some of the precursor remaining unreacted while it is in the reaction chamber;

utilizing a plurality of precursor traps along the flow path to recycle the unreacted precursor; the precursor traps being configured to selectively trap and release the precursor; and

alternately cycling the precursor traps between trapping and releasing modes relative to one other so that each of the precursor traps is alternately utilized as a source of precursor upstream of the reaction chamber and utilized for trapping unreacted precursor downstream of the reaction chamber.

12. The deposition method of claim 11 wherein the precursor traps are operated under conditions which retain trapped unreacted precursor at temperatures which preclude oxidation of the trapped unreacted precursor by any oxygen that may be present in the trap.

13. The deposition method of claim 12 wherein the trapped unreacted precursor comprises Rh, and wherein the conditions include a trapping temperature of less than or equal to -40°C.

14. The deposition method of claim 11 wherein the precursor comprises a transition metal and/or a lanthanide series metal.

15. The deposition method of claim 11 being an ALD method.

16. The deposition method of claim 11 being a CVD method.

17. An ALD method, comprising:

flowing a precursor into a reaction chamber;

after flowing the precursor into the reaction chamber, and while reactant is not in the chamber, exhausting material from the reaction chamber along a first flow path; the first flow path extending to a main pump, and including a precursor trap configured to collect unreacted precursor;

after flowing the reactant into the reaction chamber, and while the precursor is not within the reaction chamber, exhausting material from the reaction chamber along a second flow path extending to the main pump and by-passing the precursor trap; and

utilizing at least one flow control structure along the second flow path to preclude back-flow along said second flow path.

18. The ALD method of claim 17 wherein the precursor comprises metal, silicon or germanium; and wherein the reactant comprises oxygen or nitrogen.

19. The ALD method of claim 17 wherein the precursor comprises palladium, platinum, yttrium, aluminum, iridium, silver, gold, tantalum, rhodium, ruthenium or rhenium.

20. The ALD method of claim 17 wherein the precursor comprises $(CH_3)_3(CH_3C_5H_4)Pt$.

21. The ALD method of claim 20 wherein the reactant comprises one or more of O_2, water and ozone.

22. The ALD method of claim 17 wherein the precursor is flowed into the reaction chamber before the reactant.

23. The ALD method of claim 17 wherein the precursor is flowed into the reaction chamber after the reactant.

24. The ALD method of claim 17 wherein the at least one flow control structure comprises a turbopump, destruct unit or a cryopump.

25. The ALD method of claim 17 wherein the at least one flow control structure comprises a check-valve.

26. A CVD method, comprising:

flowing a mixture of materials into a reaction chamber, the mixture comprising one or more precursors and one or more reactants;

reacting the one or more reactants with the one or more precursors to form a deposit; some of the one or more precursors remaining unreacted;

after the reacting, exhausting the reaction chamber, the exhaust from the reaction chamber comprising the remaining unreacted one or more precursors; and

flowing the exhaust across at least one precursor trap configured to selectively trap at least one of the one or more unreacted precursors relative to other components of the exhaust, the at least one precursor trap being configured to retain the trapped precursor under conditions that preclude reaction of the trapped precursor with other components of the exhaust.

27. The CVD method of claim 26 wherein the at least one precursor trap is operated under conditions which retain trapped unreacted precursor at a temperature which precludes oxidation of the trapped unreacted precursor by any oxygen that may be present in the trap.

28. The deposition method of claim 27 wherein the trapped unreacted precursor comprises Rh, and wherein the conditions include a trapping temperature of less than or equal to -40°C.

29. The CVD method of claim 26 wherein the precursors comprise platinum, the reactants comprise oxygen, and the at least one precursor trap retains unreacted platinum-containing precursor at a temperature less than or equal to about 10°C.

Claims

1. A deposition system, comprising:

a reaction chamber;

a plurality of precursor traps in fluid communication with the reaction chamber; the precursor traps being configured to trap precursor under a first condition, and to release the trapped precursor under a second condition;

a flow path along which precursor is flowed to the chamber, through the chamber, and from the chamber;

wherein at least two of the precursor traps are connected in parallel relative to one another along the flow path so that one of said at least two of the precursor traps may be used as a source of precursor for reactions in the chamber while another of the at least two of the precursor traps is utilized for collecting unreacted precursor exiting from the chamber;

wherein the precursor traps are configured to selectively trap the unreacted precursor relative to oxygen;

wherein oxygen flows through the traps while unreacted precursor is retained in the traps; and

wherein the traps are configured to preclude oxidation of the trapped unreacted precursor with the oxygen.

2. A deposition method, comprising:

flowing precursor through a reaction chamber; the precursor being flowed along a flow path; the flow path extending from upstream of the reaction chamber to the reaction chamber, and from the reaction chamber to downstream of the reaction chamber; some of the precursor reacting while in the reaction chamber, and some of the precursor remaining unreacted while it is in the reaction chamber;

utilizing a plurality of precursor traps along the flow path to recycle the unreacted precursor; the precursor traps being configured to selectively trap and release the precursor;

alternately cycling the precursor traps between trapping and releasing modes relative to one other so that each of the precursor traps is alternately utilized as a source of precursor upstream of the reaction chamber and utilized for trapping unreacted precursor downstream

of the reaction chamber;

wherein the precursor traps are configured to selectively trap the unreacted precursor relative to oxygen;

wherein oxygen flows through the traps while unreacted precursor is retained in the traps; and

wherein the traps are configured to preclude oxidation of the trapped unreacted precursor with the oxygen.

3. The deposition method of claim 2 wherein the precursor traps are operated under conditions which retain trapped unreacted precursor at temperatures which preclude oxidation of the trapped unreacted precursor by any oxygen that may be present in the trap, and wherein the trapped unreacted precursor comprises Rh, and wherein the conditions include a trapping temperature of less than or equal to -40°C.

4. A CVD method, comprising:

flowing a mixture of materials into a reaction chamber, the mixture comprising one or more precursors and one or more reactants;

reacting the one or more reactants with the one or more precursors to form a deposit; some of the one or more precursors remaining unreacted;

after the reacting, exhausting the reaction chamber, the exhaust from the reaction chamber comprising the remaining unreacted one or more precursors;

flowing the exhaust across at least one precursor trap configured to selectively trap at least one of the one or more unreacted precursors relative to oxygen;

wherein oxygen flows through the at least one precursor trap while the at least one of the unreacted precursors is trapped; and

wherein the at least one precursor trap is configured to preclude oxidation of trapped unreacted precursor with the oxygen.

5. The CVD method of claim 4 wherein the at least one precursor trap is operated under conditions which retain trapped unreacted precursor at a temperature which precludes oxidation of the trapped unreacted precursor by any oxygen that may be present in the trap,

and wherein the trapped unreacted precursor comprises Rh, and wherein the conditions include a trapping temperature of less than or equal to -40°C.

6. The CVD method of claim 4 wherein the precursors comprise platinum, and wherein the at least one precursor trap retains unreacted platinum-containing precursor at a temperature less than or equal to 10°C.

7. The CVD method of claim 4 utilizing a plurality of precursor traps arranged in series along a flow path of the exhaust.