

What is claimed is:

1. A vapor delivery system for vaporizing a solid or liquid precursor, the system comprising:

a housing body defining an interior volume therein;

a housing lid comprising a gas inlet and a gas outlet,

a plurality of flow resistors, fluidically connected to the gas inlet, configured and adapted to receive a carrier gas from the gas inlet and generate gas distribution lines in the interior volume;

at least two compartments or channels, contained in a lower portion of the interior volume and having the solid or liquid precursor therein, the at least two compartments or channels configured and adapted to allow passage of the carrier gas thereover along the gas distribution lines to mix with a vapor from the solid or liquid precursor therein;

a gas-collecting device downstream of the at least two compartments or channels, fluidically connected to the gas outlet in the housing lid,

the gas-collecting device configured and adapted to deliver a mixture of the carrier gas and the vapor from the solid or liquid precursor out of the system; and

a flow controller fluidically connected to a carrier gas source, the flow controller being configured and adapted to control a feed flow rate of the carrier gas into the interior volume through the gas inlet,

wherein a gas distribution flow rate of the carrier gas along each gas distribution line is controlled by the feed flow rate of the carrier gas feeding into the gas inlet.

2. The vapor delivery system of claim 1, further comprising baffles on the inner side of the housing lid, the baffles configured and adapted to create a turbulence to make the carrier gas and the vapor from the solid precursor efficiently mixed, wherein the baffles are composed of strip-shaped bars on the inner side of the housing lid perpendicular to a flow direction of the carrier gas and the side view of the baffles is in a saw-tooth shape, a triangle shape, a sine wave shape, or a side-by-side semi-circle shape.

3. The vapor delivery system of claim 1, further comprising at least two inside walls in the interior volume configured and adapted to separate the interior volume into at least three sections including the first, the second and the third sections, wherein the second section

is adjacent to the first section and the third section and located in between the first section and the third section.

4. The vapor delivery system of claim 3, wherein each inside wall is fixed on the bottom of the interior volume and the sidewall of the interior volume, and perpendicular to the surface of the bottom and the sidewalls of the interior volume.

5. The vapor delivery system of claim 3, wherein the height of the two inside walls is shorter than the height of the sidewall of the interior volume, so that the at least three sections open into a common area forming a single continuous top compartment in the top portion of the interior volume through which the gas distribution lines pass.

6. The vapor delivery system of claim 3, wherein the plurality of flow resistors and the gas-collecting device are, respectively, a part of the first and the third sections to receive the carrier gas from the gas inlet, generate the gas distribution lines in the interior volume and deliver a mixture of the carrier gas and the vapor from the solid or liquid precursor to the gas outlet.

7. The vapor delivery system of claim 3, further comprising dividers separating the second section into the at least two compartments or channels, wherein each divider is connected to the at least two inside walls and the bottom of the interior volume at a substantially 90° angle.

8. The vapor delivery system of claim 7, wherein the height of each divider is higher than those of the at least two inside walls so that each divider is able to touch or engage with corresponding structures formed on the inner side of the housing lid once the housing body and the housing lid are assembled.

9. The vapor delivery system of claim 1, wherein the flow resistors are holes filled with a porous material.

10. The vapor delivery system of claim 9, wherein the porous material within the holes is further contained by a metal element selected from a metal tube, a metal sphere, or a metal plate.

11. The vapor delivery system of claim 10, wherein the flow resistors have an average size ranging from about 1 mm to about 1 cm.
12. The vapor delivery system of claim 10, wherein pores in the porous material have an average pore size of approximately 1 micrometer or less.
13. The vapor delivery system of any of claims 1 to 12, wherein the gas distribution flow rates of the carrier gas along the gas distribution lines are about the same.
14. The vapor delivery system of any of claims 1 to 12, wherein a top view of the at least two compartments or channels is in a shape selected from a linear shape, an S-shape or a zigzag shape.
15. The vapor delivery system of any of claims 1 to 12, wherein the carrier gas is N₂, Ne, Ar, Kr or Xe.
16. The vapor delivery system of any of claims 1 to 12, wherein an aspect ratio of length versus diameter (or maximum distance across) of the at least two compartments or channels is approximately 10 to 1, wherein the diameter of each at least two compartments or channels ranges from ½" to 2" or even larger.
17. A method for vaporizing and delivering a solid or liquid precursor, comprising the steps of:
 - placing the solid or liquid precursor in at least two compartments or channels formed in the bottom portion of an interior volume defined by a housing;
 - evaporating the solid or liquid precursor to form a vapor from the solid or liquid precursor;
 - feeding a carrier gas into the interior volume through a porous device placed in the interior volume and fluidically connected to a gas inlet of the housing, wherein the pores in the porous device produce gas distribution lines along which the carrier gas flows and mixes with the vapor from the solid or liquid precursor to form a gas mixture;
 - adjusting a flow rate of the carrier gas fed to the interior volume, so that a flow of the carrier gas flowing along each gas distribution line is controlled by the flow of the feed carrier gas; and

delivering the mixture of the carrier gas and the vapor from the solid or liquid precursor out of the interior volume through a gas-collecting device in the interior volume fluidically connected to a gas outlet of the housing.

18. The method of claim 17, wherein the pores have an average pore size of approximately 1 micrometer or less.

19. The method of claim 17, wherein the carrier gas is N₂, Ne, Ar, Kr or Xe.

20. The method of any of claims 17 to 19, further comprising delivering the gas mixture to an ALD or CVD process chamber.