guide. The method may further include wetting a filter element that comprises a pleated filter with a set of pleats having a first set of pleat tips on an upstream side of the filter element and a second set of pleat tips on a downstream side of the filter element. The fluid can be directed through the filter element to a downstream portion of the filter cavity to provide normal flow filtration and to an outlet fluidly coupled to the upstream portion of the filter cavity.

[0014] Another embodiment can include a filter housing having an inlet defining a vertical inlet flow path and an outlet spaced from the inlet defining a vertical outlet flow path. The filter housing can comprise an upstream sidewall and a downstream sidewall and can define a filter cavity having an upstream portion in fluid communication with the inlet and a downstream portion in fluid communication with the outlet. The upstream portion of the filter cavity comprising a first portion adjacent to the upstream sidewall and a second portion fluidically coupling the inlet to the first portion of the upstream portion. A filter element may be disposed in the filter cavity at least partially overlapping the inlet on a first side of the filter element. The filter element may separate the upstream portion of the filter cavity from the downstream portion of the filter cavity. The filter element further comprising a pleated filter with a set of pleats having a first set of pleat tips on an upstream side of the filter element and a second set of pleat tips on a downstream side of the filter element, wherein the first set of pleat tips form a generally planar rectangular entrance interface with the upstream portion of the filter cavity.

[0015] Embodiments described herein can reduce or eliminate problems associated with round filters by utilizing a rectangular pleat pack. For rectangular pleat packs, the pleat pack density remains uniform through the device, may ~~maximizing~~maximize the effectiveness of the filtration area. For devices with the same filtration area, a rectangular pleat pack ~~will~~may perform as if it has more filtration area than a round pleated membrane.

[0016] As another advantage, a rectangular shaped pleat pack ~~generally~~may allows for taller pleats than that of a round filter cartridge. Therefore, the a rectangular pleat pack can better fill a volume and provide a more uniform shape than a round pleat pack, thereby reducing the envelope dimensions for a rectangular pleat pack device.

[0017] As another advantage, one embodiment described herein provides a housing that is split along the length of the device (running in the same direction as the pleats), allowing for geometry, such as ribs (with flow spaces), to be created perpendicular to the pleat direction.

This provides the pleat pack support directly in the shell/housing, eliminating the need to have a separate cage to support the outside geometry of the pleat pack.

According to the first aspect of the present invention, there is provided a filter assembly for filtering semiconductor manufacturing process fluids, the filter assembly comprising: a filter housing having a filter inlet defining an inlet flow path and a filter outlet spaced from the filter inlet defining an outlet flow path, the filter housing defining a filter cavity at least partially defined by an upstream sidewall, a downstream sidewall, a third wall running from the upstream sidewall to the downstream sidewall and a fourth wall running from the upstream sidewall to the downstream sidewall, the filter cavity comprising an upstream portion of the filter cavity in fluid communication with the inlet and a downstream portion of the filter cavity in fluid communication with the outlet; and a filter element comprising a filter membrane to filter micron or submicron impurities from a semiconductor manufacturing process fluid disposed in the filter cavity, the filter element at least partially overlapping the filter inlet on a first side of the filter element, the filter element separating the upstream portion of the filter cavity from the downstream portion of the filter cavity, the filter element further comprising a rectangular pleated filter with a set of pleats having a first set of pleat tips facing the upstream sidewall on an upstream side of the filter element and a second set of pleat tips facing the downstream sidewall on a downstream side of the pleated filter, the set of pleats packed together such that the first set of pleat tips form a generally planar rectangular entrance interface and the second set of pleat tips form a rectangular generally planar exit interface and wherein the primary flow path of the fluid through the filter element is perpendicular to the flow path through the filter inlet.

According to the second aspect of the present invention, there is provided a method for filtering a liquid comprising: receiving a semiconductor manufacturing process fluid into an upstream portion of a filter cavity through an inlet defining an inlet flow path in a first direction; redirecting the liquid in a second direction to an upstream sidewall on an upstream side of a filter element using a flow guide; wetting a filter element, the filter element comprising a filter membrane to filter micron or submicron impurities from the semiconductor manufacturing process fluid, wherein the filter element comprises a pleated filter with a set of pleats having a first set of pleat tips on an upstream side of the filter element and a second set of pleat tips on a downstream side of the filter element, the set of pleats packed together such that the first set of pleat tips form a generally planar rectangular entrance interface with the upstream portion of the filter cavity and the second set of pleat tips form a generally planar rectangular exit interface with the downstream portion of the filter cavity; directing fluid through the filter element to a downstream portion of the filter cavity, wherein to provide normal flow filtration and wherein the

primary flow path through the filter element is perpendicular to the flow path through the filter inlet; and directing fluid to an outlet fluidly coupled to the downstream portion of the filter cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The drawings accompanying and forming part of this specification are included to depict certain aspects of the disclosure. It should be noted that the features illustrated in the drawings are not necessarily drawn to scale. A more complete understanding of the disclosure and the advantages thereof may be acquired by referring to the following description, taken in conjunction with the accompanying drawings in which like reference numbers indicate like features and wherein:

[0019] FIGURE 1 is a diagrammatic representation of one embodiment of a filter assembly;

[0020] FIGURES 2A-2C are diagrammatic representations of one embodiment of a filter assembly arranged as a filter cassette;

[0021] FIGURE 3 is an exploded view of one embodiment of a filter assembly;

[0022] FIGURES 4A-C are diagrammatic representations of one embodiment of a main shell housing portion;

[0023] FIGURE 5A-B are diagrammatic representations of one embodiment of a second housing portion;

[0024] FIGURE 6 is a diagrammatic representation of one embodiment of a filter cover;

[0025] FIGURE 7 is a diagrammatic representation of a cross section of one embodiment of a filter cassette;

[0026] FIGURE 8 is a diagrammatic representation of one embodiment of coupling a filter cover to a main shell;

[0027] FIGURE 9 is a diagrammatic representation of a view of one embodiment of a filter cassette;

[0028] FIGURE 10 is a diagrammatic representation of the hydraulic profiles of one embodiment of a filter cassette;

[0029] FIGURE 11 is a diagrammatic representation of another embodiment of a filter cassette;

~~NEW~~ CLAIMS:

1. A filter assembly for filtering semiconductor manufacturing ~~liquids~~ process fluids, the filter assembly comprising:

a filter housing having a filter inlet defining an inlet flow path and a filter outlet spaced from the filter inlet defining an outlet flow path, the filter housing defining a filter cavity at least partially defined by an upstream sidewall, a downstream sidewall, a third wall running from the upstream sidewall to the downstream sidewall and a fourth wall running from the upstream sidewall to the downstream sidewall, the filter cavity comprising an upstream portion of the filter cavity in fluid communication with the inlet and a downstream portion of the filter cavity in fluid communication with the outlet; and

a filter element comprising a filter membrane to filter micron or submicron impurities from a semiconductor manufacturing process ~~fluids~~fluid disposed in the filter cavity, the filter element at least partially overlapping the filter inlet on a first side of the filter element, the filter element separating the upstream portion of the filter cavity from the downstream portion of the filter cavity, the filter element further comprising a rectangular pleated filter with a set of pleats having a first set of pleat tips facing the upstream sidewall on an upstream side of the filter element and a second set of pleat tips facing the downstream sidewall on a downstream side of the pleated filter, the set of pleats ~~compressed~~packed together such that ~~the pleats are not separated,~~ the first set of pleat tips form a generally planar rectangular entrance interface and the second set of pleat tips form a rectangular generally planar exit interface and wherein the primary flow path of the fluid through the filter element is perpendicular to the flow path through the filter inlet.

2. The filter assembly of Claim 1, wherein:

the set of pleats are pleated parallel to a long axis of the filter cavity; and

the filter element is potted to seal a first end of the filter cavity and a second end of the filter cavity, the first end of the filter cavity and the second end of the filter cavity spaced by the long axis of the filter cavity.

3. The filter assembly of Claim 1, further comprising a flow guide disposed between the inlet and the filter element, the flow guide configured to direct flow from the inlet to an upstream sidewall.

4. The filter assembly of Claim 1, further comprising a shifted parallelogram filter holding area, wherein the filter element is disposed in the shifted parallelogram filter ~~element~~ holding area such that the first set of pleat tips and the distance between the first set of pleat

tips and the upstream sidewall continually decreases in a direction from the third wall to the fourth wall, wherein the inlet interfaces with the filter cavity on a third wall running between the upstream sidewall and the downstream sidewall.

5. The filter assembly of Claim 4, further comprising a filter cover disposed on a downstream side of the filter element and contacting ~~the second set of pleat tips~~ the filter element, the filter cover running a length of the filter cavity and tilted toward the upstream sidewall to at least partially define the filter element holding area and spanning between the third sidewall and the fourth sidewall, the filter cover comprising a set of spaced intermediate members and defining openings between the set of spaced intermediate members to allow fluid to flow from the filter element and through the filter cover.

6. The filter assembly of Claim 5, wherein the filter element comprises a first flap and a second flap and wherein the first flap and second flap are captured between the filter cover and the filter housing.

7. The filter assembly of Claim 1, wherein the filter housing comprises symmetric main body portions.

8. The filter assembly of Claim 1, wherein the upstream portion of the filter cavity is shaped such that the upstream portion of the filter cavity has a decreasing hydraulic diameter away from the filter inlet and the downstream portion of the filter cavity is shaped to have an increasing hydraulic diameter toward the outlet

9. The filter assembly of Claim 1, further comprising a flow guide to direct flow horizontally from the inlet to the upstream sidewall.

10. The filter assembly of Claim 9, wherein the pleated filter comprises the flow guide.

11. The filter assembly of Claim 9, wherein the flow guide comprises at least a portion of the filter element.

12. A method for filtering a liquid comprising:

receiving a semiconductor manufacturing process ~~liquid~~fluid into an upstream portion of a filter cavity through an inlet defining an inlet flow path in a first direction;

redirecting the liquid in a second direction to an upstream sidewall on an upstream side of a filter element using a flow guide;

wetting a filter element, the filter element comprising a filter membrane to filter micron or submicron impurities from the semiconductor manufacturing process fluid, wherein the filter element comprises a pleated filter with a set of pleats having a first set of pleat tips on an upstream side of the filter element and a second set of pleat tips on a downstream side of the filter element, the set of pleats ~~compressed~~packed together such that ~~the pleats are not separated,~~ the first set of pleat tips form a generally planar rectangular entrance interface with the upstream portion of the filter cavity and the second set of pleat tips form a generally planar rectangular exit interface with the downstream portion of the filter cavity;

directing fluid through the filter element to a downstream portion of the filter cavity, wherein to provide normal flow filtration and wherein the primary flow path through the filter element is perpendicular to the flow path through the filter inlet; and

directing fluid to an outlet fluidly coupled to the downstream portion of the filter cavity.

13. The method of Claim 12, wherein the pleated filter acts as the flow guide.

14. The method of Claim 12, wherein the pleated filter is disposed as a shifted parallelogram.

15. The method of Claim 12, wherein the second direction is perpendicular to the first direction.

16. The filter assembly of Claim 1, wherein:

the filter inlet defines a generally vertically upward flow path;

the filter outlet defines a generally vertically upward flow path;

the filter assembly comprises bottom offsets projecting upward from a bottom of the filter cavity and sidewall offsets projecting into the filter cavity from the upstream sidewall;

the pleated filter is pleated parallel to a long axis of the filter housing, is supported by the bottom offsets and comprises a top ~~flap~~ pleat and a bottom ~~flap~~ pleat, wherein the bottom ~~flap~~pleat overlaps the filter inlet and the top ~~flap~~pleat does not overlap the filter outlet;

a filter cover disposed on a downstream side of the filter element; and

wherein the pleated filter is disposed in a shifted parallelogram fitter holding area.

17. The filter assembly of Claim 1, further comprising a vent open to a highest area of the upstream portion of the cavity or the downstream portion of the cavity, wherein the filter housing is formed of a material that is more philic to gas than the material of the filter membrane.

18. The filter assembly of Claim 11, wherein the filter housing is configured to maintain a ratio of fluid volume to hydraulic diameter in the upstream portion of the filter cavity and the downstream portion of the filter cavity.