CLAIMS

What is claimed is:

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

a first fluid supply configured to supply a first process fluid;

a second fluid supply configured to supply a second process fluid;

a process chamber configured to process articles;

a fluid delivery module, the fluid delivery module comprising:

a first inlet fluidly coupled to the first fluid supply;

a second inlet fluidly coupled to the second fluid supply;

an outlet fluidly coupled to the process chamber;

a flow passage extending from the first and second inlets to the outlet;

a first flow component, the first flow component comprising:

a component body;

a first port, a second port, and a third port, each of the first, second, and third ports formed in the component body, a first flow path extending from the first port to a junction, a second flow path extending from the second port to the junction, and a third flow path extending from the junction to the third port, the first, second, and third flow paths each forming a portion of the flow passage; and

a mixing element, the mixing element located at the junction of the first flow component, the mixing element comprising a first fluid inlet, a second fluid inlet, and a fluid outlet, the first fluid inlet fluidly coupled to the first port, the second fluid inlet fluidly coupled to the second port, and the fluid outlet fluidly coupled to the third port.

2. The system of claim 1 wherein the mixing element comprises a tubular body, the tubular body extending along a longitudinal axis of the mixing element from an open end to a closed end, wherein the tubular body comprises an outer surface and an inner surface, and wherein both the outer surface and the inner surface extend from the open end to the closed end.

3. The system of claim 2 wherein the first and second fluid inlets of the mixing element extend from the outer surface to the inner surface.

4. The system of claim 2 wherein the open end of the tubular body forms the fluid outlet of the mixing element.

5. The system of claim 2 wherein the outer surface comprises a first sealing surface proximate the closed end, a second sealing surface proximate the open end, and a groove surface extending from the first sealing surface to the second sealing surface, and wherein the first fluid inlet and the second fluid inlet are formed into the groove surface.

6. The system of claim 2 wherein the first fluid inlet extends along a first inlet axis, the first inlet axis perpendicular to the longitudinal axis, wherein the first inlet axis does not intersect the longitudinal axis.

7. The system of claim 2 wherein the first fluid inlet has a first inlet surface, the first inlet surface extending from the outer surface to the inner surface, wherein the first inlet surface meets the inner surface at a point of tangency, the first inlet surface being tangent to the inner surface at the point of tangency.

8. The system of claim 2 wherein the mixing element comprises a flange at the closed end.

9. The system of claim 1 wherein the first flow component comprises a first assembly port, the mixing element and a retention component installed in the first assembly port.

10. The system of claim 9 wherein the first assembly port of the first flow component comprises an annular rib and the mixing element comprises a flange at a closed end, the flange comprising a flange groove configured to receive the annular rib of the first flow component.

11. A mixing element, the mixing element comprising:

a tubular body extending along a longitudinal axis of the mixing element from an open end to a closed end, the tubular body having an outer surface and an inner surface;

a first fluid inlet formed through the tubular body from the outer surface to the inner surface;

a second fluid inlet formed through the tubular body from the outer surface to the inner surface;

a fluid outlet formed by the open end of the tubular body.

12. The mixing element of claim 11 wherein both the outer surface and the inner surface extend from the open end to the closed end.

13. The mixing element of claim 11 wherein the outer surface comprises a first sealing surface proximate the closed end, a second sealing surface proximate the open end, and a groove surface extending from the first sealing surface to the second sealing surface; and wherein the first fluid inlet and the second fluid inlet are formed into the groove surface.

14. The mixing element of claim 11 wherein the first fluid inlet extends along a first inlet axis, the first inlet axis perpendicular to the longitudinal axis, and wherein the first inlet axis is spaced from the longitudinal axis.

15. The mixing element of claim 14 wherein the first inlet axis does not intersect the longitudinal axis.

16. The mixing element of claim 14 wherein the second fluid inlet extends along a second inlet axis, the second inlet axis parallel to the first inlet axis and perpendicular to the longitudinal axis, and wherein the second inlet axis does not intersect the longitudinal axis.

17. The mixing element of claim 11 wherein the first fluid inlet has a first inlet surface, the first inlet surface extending from the outer surface to the inner surface.

18. The mixing element of claim 11 wherein the first fluid inlet comprises a slot, the slot being elongate along the longitudinal axis.

19. The mixing element of claim 11 wherein the first fluid inlet comprises a plurality of holes, wherein each hole of the plurality of holes has a diameter, the diameter of each hole of the plurality of holes being different, and wherein the diameters of the plurality of holes decrease with increasing distance from the closed end of the tubular body along the longitudinal axis.

20. A method of mixing process fluids, the method comprising:

a) providing a first fluid supply configured to supply a first process fluid and a second fluid supply configured to supply a second process fluid;

b) flowing the first process fluid to a mixing element of a first flow component and the second process fluid to the mixing element of the first flow component;

c) passing the first process fluid through a first fluid inlet formed in a tubular body of the mixing element, the first fluid inlet extending along a first inlet axis perpendicular to a longitudinal axis of the mixing element;

d) passing the second process fluid through a second fluid inlet formed in the tubular body of the mixing element, the second fluid inlet extending along a second inlet axis perpendicular to the longitudinal axis;

e) comingling the first and second process fluids within the tubular body of the mixing element to form a fluid mixture;

f) flowing the fluid mixture through an open end of the tubular body, the open end forming an outlet of the mixing element.