CLAIMS

We claim:

1. A reactor system, comprising:

a reactor vessel configured to contain a process fluid;

a sparger assembly fluidly coupled to the reactor vessel and configured to supply a mixture of a gas and the process fluid to the reactor vessel, wherein the sparger assembly comprises a plurality of sparger chambers, and wherein each sparger chamber of the plurality of sparger chambers comprises:

a process fluid conduit fluidly coupled to a process fluid return of the reactor vessel via a process fluid inlet, wherein the process fluid inlet comprises a first block and bleed valve assembly;

a sparger conduit fluidly coupled to the process fluid conduit;

a sparger disposed within the sparger conduit and fluidly coupled to a gas source via a gas inlet; and

a process fluid-gas mixture outlet that fluidly couples the sparger conduit to the reactor vessel, wherein the process fluid-gas mixture outlet comprises a second block and bleed valve assembly disposed between the sparger conduit and the reactor vessel, wherein the first and second block and bleed valve assemblies are configured to enable the sparger to be fluidly isolated from the reactor vessel.

2. The system of claim 1, wherein the sparger assembly comprises one or more process fluid headers fluidly coupled between the process fluid return of the reactor vessel and the process fluid inlet of each of the plurality of sparger chambers.

3. The system of claim 1, wherein the sparger assembly comprises one or more gas headers fluidly coupled between the gas source and the gas inlet of each of the plurality of sparger chambers.

4. The system of claim 1, wherein the sparger comprises a plurality of fine-pore sparging elements disposed on a surface of the sparger, wherein each of the plurality of pores comprises a first diameter.

5. The system of claim 4, wherein the sparger conduit comprises a second diameter, wherein a ratio of the first diameter to the second diameter is less than 0.01.

6. The system of claim 1, wherein the reactor vessel comprises a set of fluid recirculation nozzles disposed above the sparger outlets of the sparger assembly and fluidly coupled to the process fluid return of the reactor vessel.

7. The system of claim 1, wherein each process fluid-gas mixture outlet is disposed in a sparger plate in a lower portion of the reactor vessel.

8. The system of claim 1, wherein the sparger assembly is external to the reactor vessel.

9. A sparger assembly for a reactor, the sparger assembly comprising: a plurality of sparger chambers, and wherein each sparger chamber of the plurality of sparger chambers comprises:

a process fluid conduit fluidly coupled to a process fluid inlet, wherein the process fluid inlet comprises a first block and bleed valve assembly;

a sparger conduit fluidly coupled to the process fluid conduit;

a sparger disposed within the sparger conduit and fluidly coupled to a gas inlet; and

a process fluid-gas mixture outlet fluidly coupled to the sparger conduit, wherein the process fluid-gas mixture outlet comprises a second block and bleed valve assembly, wherein the first block and bleed valve assembly and the second block and bleed valve assembly are configured to enable the sparger assembly to be fluidly isolated.

10. The sparger of claim 9, wherein the sparger assembly comprises one or more process fluid headers fluidly coupled to the process fluid inlet of each of the plurality of sparger chambers.

11. The sparger of claim 9, wherein the sparger assembly comprises one or more gas headers fluidly coupled to the gas inlet of each of the plurality of sparger chambers.

12. The sparger of claim 9, wherein the sparger comprises a plurality of fine-pore sparging elements disposed on a surface of the sparger, wherein each of the plurality of pores comprises a first diameter.

13. The sparger of claim 12, wherein the sparger conduit comprises a second diameter, wherein a ratio of the first diameter to the second diameter is less than 0.01.

14. The sparger of claim 9, wherein the reactor vessel comprises a set of fluid recirculation nozzles disposed above the sparger outlets of the sparger assembly and fluidly coupled to the process fluid return of the reactor vessel.

15. The sparger of claim 9, wherein the process fluid conduit is coupled to the sparger conduit at an angle between 10 and 90 degrees.