CLAIMS

What is claimed is:

1. A method of cleaning surface oxides from an aircraft part to be cleaned, the method comprising:

when an opening of a furnace is closed, operating one or more vacuum pumps to achieve a predetermined vacuum level in a workspace of the furnace and heating the workspace to a predetermined temperature using heating elements, the workspace being completely contained within an interior of the furnace and being defined by one or more internal walls of the furnace;

operating a gas purifier to remove impurities in a gas to create a purified gas, the purified gas being of a purity and composition that is effective to disassociate oxides on a surface or in a crack of the aircraft part to be cleaned when the workspace is heated to the predetermined temperature and the predetermined vacuum level is achieved in the workspace;

disposing a containment structure within the workspace and placing the aircraft part to be cleaned within the containment structure, the containment structure occupying a first volume that is substantially less than a second volume occupied by the workspace; and

directing the purified gas into the containment structure via a passageway or pipe that is coupled to the containment structure and crosses portions of the workspace, all the heating elements being disposed outside the containment structure on the one or more internal walls, the containment structure being configured to completely enclose and surround the aircraft part to be cleaned and having a first opening in communication with the pipe or passageway to allow the purified gas to be drawn into the containment structure from the passageway or pipe, the purified gas then proceeding in a stream across a length of the containment structure and the aircraft part to be cleaned and being drawn through the containment structure by the one or more vacuum pumps, the purified gas exiting the containment structure via a second opening in the containment structure without dispersing into the workspace.

2. The method of claim 1, wherein the one or more vacuum pumps are selected from the group consisting of : a roughing pump configured to provide a first value of first vacuum level measurement in the workspace, a blower pump configured to provide a second value of

second vacuum level measurement in the workspace and a diffusion pump configured to provide a third value of third vacuum level measurement in the workspace, wherein the first value is greater than the second value, and the second value is greater than the third value.

3. The method of claim 1, wherein the one or more internal walls comprise an outer wall of the furnace and an inner wall of the furnace, the outer wall surrounding and spaced from the inner wall.

4. The method of claim 1, wherein the purified gas has a purity level that is greater than 99.9999%.

5. The method of claim 1, wherein the gas is hydrogen or argon, and the purified gas is purified hydrogen or purified argon.

6. The method of claim 1, wherein the predetermined temperature is greater than 1500 degrees F and the predetermined vacuum level is less than 10^{-5} Torr.

7. The method of claim 1, wherein the opening comprises a door.

8. The method of claim 1, further comprising controlling operation of the heating elements, the gas purifier, and the one or more vacuum pumps using a controller.

9. The method of claim 8, wherein the controller controls operation of the heating element to vary the predetermined temperature over time.

10. The method of claim 3, wherein the outer wall is spaced from the inner wall by a third volume, the third volume being filled with a cooling fluid or insulating material.

11. The method of claim 1, wherein the one or more internal walls are spherical.

12. The method of claim 1. Wherein the containment structure comprises multiple containment structures and wherein the multiple containment structures are configured to hold different aircraft parts to be cleaned.

13. A method of cleaning surface oxides from aircraft parts to be cleaned, the method comprising:

disposing containment structures within a workspace of a furnace and placing aircraft parts to be cleaned within the containment structures, each of the containment structures occupying a first volume that is substantially less than a second volume occupied by the workspace, the workspace being completely contained within an interior of the furnace and being defined by one or more internal walls of the furnace;

when an opening of the furnace is closed, operating one or more vacuum pumps coupled to the furnace to achieve a predetermined vacuum level in the workspace of the furnace and heating the workspace to a predetermined temperature;

supplying gas to a gas purifier;

operating the gas purifier to remove impurities in the gas to create a purified gas, the purified gas being of a purity and composition that is effective to disassociate oxides on surfaces or in cracks of the aircraft parts to be cleaned when the workspace is heated to the predetermined temperature and the predetermined vacuum level is achieved in the workspace; and

directing the purified gas into each of the containment structures via a passageway or pipe that is coupled to each containment structure and crosses portions of the workspace, each of the containment structures not including heating elements, the containment structures being configured to completely enclose and surround the aircraft parts to be cleaned and to allow the purified gas to be drawn across the aircraft parts to be cleaned and each having a first opening in communication with the pipe or passageway to allow the purified gas to be drawn into each containment structure from the passageway or pipe, the purified gas then proceeding in a stream across a length of each containment structure and the aircraft part to be cleaned and being drawn through each containment structure by the one or more vacuum pumps, the purified gas exiting the containment structures via a second opening in each containment structure without dispersing into the workspace.

14. The method of claim 13, wherein the one or more vacuum pumps are selected from the group consisting of: a roughing pump configured to provide a first value of first vacuum level measurement in the workspace, a blower pump configured to provide a second value of second vacuum level measurement in the workspace and a diffusion pump configured to provide a third value of third vacuum level measurement in the workspace, wherein the first value is greater than the second value, and the second value is greater than the third value.

15. The method of claim 13, wherein the purified gas has a purity level that is greater than 99.9999%.

16. The method of claim 13, wherein the gas is hydrogen or argon, and the purified gas is purified hydrogen or purified argon.

17. The method of claim 13, wherein the predetermined temperature is greater than 1500 degrees F. and the predetermined vacuum level is less than 10^{-5} Torr.

18. The method of claim 13, wherein the opening comprises a door.