CLAIMS

1. An apparatus for maintaining a pressure different from atmospheric pressure, the apparatus comprising:

a plurality of structural members coupled together to at least partially define a space which is configured to have a pressure different from atmospheric pressure, a structural member of the plurality of structural members being a support structure having an array of holes; and

a film covering a surface of the support structure having an array of holes;

wherein the film is adapted to allow a predetermined range of wavelengths of electromagnetic waves to pass through.

2. The apparatus according to claim 1,

wherein a further structural member of the plurality of structural members comprises a port; and

wherein the apparatus comprises a pressure difference generator coupled to the port and configured to generate the pressure.

3. The apparatus according to claim 1,

wherein the plurality of structural members and the film form an enclosed chamber defining the space.

4. The apparatus according to claim 1,

wherein the plurality of structural members and the film are configured to define the space with a surface of an object when the apparatus is arranged onto the surface of the object.

5. The apparatus according to claim 4, further comprising:

a sealing rubber structure coupled to the plurality of structural members so that the sealing rubber structure is configured to contact the surface of the object when the apparatus is arranged onto the surface of the object,

wherein the sealing rubber structure is made of foam material.

6. The apparatus according to claim 1, further comprising:

a clamping mechanism attached to a structural member other than the support structure having the array of holes;

wherein the clamping mechanism forms an air tight seal between edges of the film and the structural member attached to the clamping mechanism.

7. The apparatus according to claim 1,

wherein the array of holes occupies more than 50% of an area within the support structure.

8. The apparatus according to claim 1,

wherein each hole of the array of holes is of a size and a shape such that the film is within an ultimate tensile stress limit of the film upon achieving a predetermined pressure difference.

9. The apparatus according to claim 1,

wherein the plurality of structural members is coupled together to at least partially define a main chamber containing the space, and also to at least partially define a secondary chamber containing a further space configured to have a further pressure different from the pressure in the main chamber.

10. The apparatus according to claim 9,

wherein the plurality of structural members comprises one or more partition walls separating the main chamber and the secondary chamber; and

wherein the plurality of structural members comprises one or more external walls separating the main chamber from an external environment.

11. The apparatus according to claim 10, further comprising:

a sealing film attached to the one or more partition walls for enclosing the secondary chamber.

12. The apparatus according to claim 11,

wherein the one or more structural members comprise a main chamber port and a secondary chamber port;

wherein the apparatus further comprises:

a vacuum pump coupled via the main chamber port to the main chamber, the vacuum pump configured to generate a vacuum in the main chamber; and

a pressure difference generator coupled via the secondary chamber port to the secondary chamber.

13. The apparatus according to claim 12,

wherein the sealing film is configured to apply a compaction force on a non-polymerized composite patch, the composite patch arranged on a surface of an object, in response to a pressure difference between the main chamber and the secondary chamber.

14. The apparatus according to claim 13,

wherein the pressure difference generator comprises:

a vacuum pump configured to generate a vacuum in the secondary chamber;

an air compressor configured to provide pressurized air to the secondary chamber; and

a switch coupling the vacuum pump to the secondary chamber port when the switch is in a first state, and coupling the air compressor to the secondary chamber port when the switch is in a second state;

wherein the switch is configured to switch between the first state, and the second state.

15. The apparatus according to claim 14,

wherein the compaction force provided by the sealing film on the non-polymerized composite patch is higher than a predetermined value upon the

air compressor increasing a pressure in the secondary chamber to a value above 1 bar; and

wherein the pressure in the main chamber is at an absolute pressure below 0.1 bar to keep the apparatus attached to the surface of the object;

wherein the compaction force provided by the sealing film on the non-polymerized composite patch is lower than the predetermined value upon the vacuum pump reducing a pressure in the secondary chamber to a value below 0.1 bar; and

wherein the pressure in the main chamber is below 0.05 bar.

16. The apparatus according to claim 15, further comprising:

a breather layer or a foam rubber spacer coupled to the one or more partition walls, the breather layer or the foam rubber spacer configured to allow a volatile substance to be drawn from the patch into the vacuum generated in the main chamber; and

a heat blanket layer coupled to the breather layer or the foam rubber spacer.

17. The apparatus according to claim 10,

wherein each of the one or more partition walls has an adjustment mechanism to vary a height of the partition wall.

18. The apparatus according to claim 14,

wherein the pressure in the main chamber (P_{main}) and the pressure in the secondary chamber ($P_{secondary}$) are related to an area covered by the main chamber (A_{main}) and an area covered by the secondary chamber ($A_{secondary}$) by an equation $A_{main} > A_{secondary} \times \frac{P_{secondary} - P_{atm}}{P_{atm} - P_{main}}$, wherein P_{atm} is the atmospheric pressure.

19. A method of forming an apparatus for maintaining a pressure different from atmospheric pressure, the method comprising:

coupling a plurality of structural members together to at least partially define a space which is configured to have a pressure different from atmospheric pressure, a structural member of the plurality of structural members being a support structure having an array of holes; and

covering a surface of the support structure having an array of holes with a film;

wherein the film is adapted to allow a predetermined range of wavelengths of electromagnetic waves to pass through.

20. A method of operating an apparatus for maintaining a pressure different from atmospheric pressure, the method comprising:

providing the apparatus comprising:

a plurality of structural members coupled together to at least partially define a space which is configured to have a pressure different from atmospheric pressure, a structural member of the plurality of structural members being a support structure having an array of holes; and

a film covering a surface of the support structure having an array of holes;

wherein the film is adapted to allow a predetermined range of wavelengths of electromagnetic waves to pass through; and

generating the pressure in the space.