CLAIMS

1. A method of production of an object in a weldable material by solid freeform fabrication, wherein the method comprises:
- creating a virtual three dimensional model of the object which is to be formed,
- dividing the virtual three dimensional model into a set of virtual parallel layers and then dividing each layer into a set of virtual quasi one-dimensional pieces, forming a virtual vectorized layered model of the object,
- loading the vectorized layered model of the object into a welding control system able to regulate the position and activation of a support substrate, high energy plasma transferred arc welding torch, and a wire feeding system placed in a closed reactor vessel,
- substituting the atmosphere inside the closed reactor vessel with an inert atmosphere with a pressure of about 10^5 Pa and which contains maximum 50 ppm oxygen,
- engaging the control system to weld a series of quasi one-dimensional pieces of the weldable material onto the supporting substrate in a pattern according to the first layer of the virtual vectorized layered model of the object,
- forming the second layer of the object by welding a series of quasi one-dimensional pieces of the weldable material onto the previous deposited layer in a pattern according to the second layer of the virtual vectorized layered model of the object, and
- repeating the welding process layer by layer for each successive layer of the virtual vectorized layered model of the object until the entire object is formed.

2. Method according to claim 1, wherein
the weldable material is a weldable metal, a weldable alloyed metal, or a polymeric material.

3. Method according to claim 2, wherein
the weldable material is titanium or alloyed titanium.

4. Method according to claims 1 - 3, wherein
the inert gas is one of argon, helium or a mixture of these.

5. Method according to claims 1- 3, wherein
the inert gas inside the reactor chamber is argon, and where the pressure of the argon is about 100 Pa above the ambient atmospheric pressure.

6. Reactor for production of an object of a weldable material by solid freeform fabrication, where the reactor comprises:
- a reactor chamber (1) which is closed to the ambient atmosphere,
- an actuator (2) controlling the position and movement of a support substrate (3) placed inside the reactor chamber,

- an actuator (4) controlling the position and movement of a high energy plasma transferred arc welding torch (5) with a wire feeder,
- a control system able to read a virtual three dimensional vectorized layered model of the object which is to be formed and employ the virtual model to control the position and movement of the actuators (2, 4), operation of the welding torch (5) and wire feeder such that a physical object is build by welding a layered structure of quasi one-dimensional pieces of the weldable material onto the supporting structure according to the virtual three dimensional vectorized layered model of the object which is to be formed,

characterised in that

- all adjacent wall elements (6) of the walls of the reactor chamber are joined with an obtuse angle (larger than 90°),
- the actuator (2) extends from below the reactor chamber and protrudes into the reactor chamber through an opening (7) in the reactor chamber wall holding the support substrate (3) inside the reactor chamber,
- the opening (7) is sealed by at least one elastic gas impermeable membrane (8) which is gas tight attached to the reactor wall at the opening (7) and to the actuator (2),
- the actuator (4) extends from the outside of the reactor chamber and protrudes into the reactor chamber through an opening (9) of the wall of reactor chamber holding the high energy plasma transferred arc welding torch (5) with wire feeder of the weldable material inside the reactor chamber,
- the opening (9) is sealed by the at least one elastic gas impermeable membrane (10) which is gas tight attached to the reactor wall at the opening (9) and to the actuator (4), and
- the reactor is equipped with at least one closable gas inlet (11) located in the lower part the reactor chamber and at least one closable gas outlet (12) located at the upper part of the reactor chamber.

7. Reactor according to claim 6, wherein

the openings (7, 9) are closed by use of a two layer gas tight elastic rubber (8, 10) which is attached by using clamping frames (109) which are attached to the reactor wall and clamping rings attached to the actuator arm (2, 4) protruding in through the opening in the reactor chamber.

8. Reactor according to claim 6 or 7, wherein

the reactor is filled with argon as inert gas and where the gas inlet (11) is equipped with means for regulating the argon pressure to about 100 Pa above the ambient atmospheric pressure.

9. Reactor according to claim 8, wherein

the reactor is equipped with means for measuring the oxygen content of the inert atmosphere inside the reactor chamber, and means to engage the flushing of the

chamber with fresh inert gas in case the oxygen concentration rises above a preset maximum value.

10. Reactor according to claim 9, wherein
the preset maximum value of the oxygen concentration is set to 20 ppm.

11. Reactor according to any of claims 6 - 10, wherein
the reactor is equipped with a closed cooling circuit comprising inert gas outlet (102), heat exchanger (101) and inert gas inlet (103) for cooling the inert gas in the reactor chamber.

12. Reactor according to any of claims 6 - 11, wherein
the obtuse angle between any adjacent wall element (6) constituting the reactor chamber internal walls, is between 95 and 130°, more preferably between 100 and 120°.

13 Reactor according to any of claims 6 - 12, wherein
the weldable material is a weldable metal, a weldable alloyed metal, or a polymeric material.

14 Reactor according to any of claims 6 - 12, wherein
the weldable material is titanium or alloyed titanium.

CLAIMS

1. Reactor for production of an object of a weldable material by solid freeform fabrication, where the reactor comprises:
- a reactor chamber (1) which is closed to the ambient atmosphere,
- an actuator (2) controlling the position and movement of a support substrate (3) placed inside the reactor chamber,
- an actuator (4) controlling the position and movement of a high energy plasma transferred arc welding torch (5) with a wire feeder,
- a control system able to read a virtual three dimensional vectorized layered model of the object which is to be formed and employ the virtual model to control the position and movement of the actuators (2, 4), operation of the welding torch (5) and wire feeder such that a physical object is build by welding a layered structure of quasi one-dimensional pieces of the weldable material onto the supporting structure according to the virtual three dimensional vectorized layered model of the object which is to be formed,
wherein the reactor is characterised in that
- all adjacent wall elements (6) forming the reactor wall of the reactor chamber are joined with an obtuse angle (larger than 90°),
- the actuator (2) protrudes into the reactor chamber through an opening (7) at the bottom of the reactor chamber holding the support substrate (3) inside the reactor chamber,
- the opening (7) is sealed by at least one elastic gas impermeable membrane (8) which is gas tight attached to the reactor wall at the opening (7) and to the actuator (2),
- the actuator (4) protrudes into the reactor chamber through an opening (9) at the side of the reactor chamber holding the high energy plasma transferred arc welding torch (5) with wire feeder of the weldable material inside the reactor chamber,
- the opening (9) is sealed by the at least one elastic gas impermeable membrane (10) which is gas tight attached to the reactor wall at the opening (9) and to the actuator (4), and
- the reactor is equipped with at least one closable gas inlet (11) located at the lowest level of the reactor chamber and at least one closable gas outlet (12) located at the highest level of the reactor chamber.

2. Reactor according to claim 1, wherein
the openings (7, 9) are closed by use of a two layer gas tight elastic rubber (8, 10) which is attached by using clamping frames (17) which are attached to the reactor wall and clamping rings (13) attached to the actuator arm (2, 4) protruding in through the opening in the reactor chamber.

3. Reactor according to claim 1 or 2, wherein
the reactor is filled with argon as inert gas and where the gas inlet (11) is equipped with means for regulating the argon pressure to about 100 Pa above the ambient atmospheric pressure.

4. Reactor according to claim 3, wherein
the reactor is equipped with means for measuring the oxygen content of the inert atmosphere inside the reactor chamber, and means to engage the flushing of the chamber with fresh inert gas in case the oxygen concentration rises above a preset maximum value.

5. Reactor according to claim 4, wherein
the preset maximum value of the oxygen concentration is set to 20 ppm.

6. Reactor according to any of claims 1 - 5, wherein
the reactor is equipped with a closed cooling circuit comprising inert gas outlet, heat exchanger and inert gas inlet for cooling the inert gas in the reactor chamber.

7. Reactor according to any of claims 1 - 6, wherein
the obtuse angle between any adjacent wall element (6) constituting the reactor chamber internal walls, is between 95 and 130°, more preferably between 100 and 120°.

8. Reactor according to any of claims 1 - 7, wherein
the weldable material is a weldable metal, a weldable alloyed metal, or a polymeric material.

9. Reactor according to any of claims 1 - 7, wherein
the weldable material is titanium or alloyed titanium.