Claims

1. A hydrogen fuel cell, characterized in that it comprises a fuel cell stack assembly and an outside plate gas distribution device;

the fuel cell stack assembly comprises a first insulating plate, a first power supply plate, a cell pack, a second power supply plate and a second insulating plate set in series; the first power supply plate and the second power supply plate function as the anode output and the cathode output of the cell pack, respectively;

the fuel cell stack assembly is encapsulated with a hard housing;

the outside plate gas distribution device is fixed on the hard housing; the outside plate gas distribution device comprises an outside plate gas distribution device for working gas flow and a heat dissipation gas distribution device; the outside plate gas distribution device for working gas flow is provided with a fan mount for connecting with a working fan, and the outside plate gas distribution device for working gas flow extends into the inner cavity of the hard housing from outside of the hard housing; the gas flow outlet of the outside plate gas distribution device for working gas flow is connected with the air inlet gas distribution nozzle of each unit cell in the cell pack;

the heat dissipation gas distribution device comprises a heat dissipation channel set outside the hard housing and interconnected with the inner cavity of the hard housing, and a heat dissipation port set on the hard housing; the heat dissipation channel is provided with a heat dissipation fan mount for connecting with a heat dissipation fan.

2. The hydrogen fuel cell according to claim 1, characterized in that the outside plate gas distribution device for working gas flow comprises a gas distribution manifold, a gas distribution groove and a gas flow outlet;

the gas distribution manifold is located outside the hard housing and fixed on the top plate of the hard housing; the gas distribution manifold is interconnected with the gas distribution groove; the gas distribution groove extends into the inner cavity of the hard housing; the gas flow outlet is formed on the bottom of the gas distribution groove; the gas flow outlet is interconnected with the air inlet gas distribution nozzle of each unit cell in the cell pack;

the gas distribution manifold is provided with the fan mount for connecting with the

working fan.

3. The hydrogen fuel cell according to claim 2, characterized in that the outside plate gas distribution device is a single-side gas distribution device; both the outside plate gas distribution device for working gas flow and the heat dissipation gas distribution device are set on the top plate of the hard housing.

4. The hydrogen fuel cell according to claim 3, characterized in that one end of the heat dissipation channel is an open end; the open end of the heat dissipation channel is provided with the heat dissipation fan mount; the heat dissipation channel is lowered gradually towards the other end from the open end and fixed and covered on the top plate of the hard housing;

the heat dissipation fan blows air into the inner cavity of the hard housing via the heat dissipation channel to cool the fuel cell stack assembly; heat dissipation air obtained after cooling the fuel cell stack assembly is exhausted from the heat dissipation port on the hard housing.

5. The hydrogen fuel cell according to claim 4, characterized in that one end of the gas distribution manifold is an open end; the open end of the gas distribution manifold is provided with the working fan mount; the gas distribution manifold is lowered gradually towards the other end from the open end.

6. The hydrogen fuel cell according to claim 5, characterized in that the open end of the gas distribution manifold and the open end of the heat dissipation channel are located on two opposite sides of the top plate of the hard housing, respectively.

7. The hydrogen fuel cell according to claim 4, characterized in that the inner wall of the heat dissipation channel is provided with a gas flow diversion damping groove.

8. The hydrogen fuel cell according to claim 2, characterized in that the outside plate gas distribution device is a double-side gas distribution device; the outside plate gas distribution device for working gas flow is set on the top plate of the hard housing; the heat dissipation channel of the heat dissipation gas distribution device is set on the bottom plate of the hard housing.

9. The hydrogen fuel cell according to claim 8, characterized in that the heat dissipation channel is a heat dissipation air collection chamber interconnected with the

inner cavity of the hard housing; the heat dissipation air collection chamber is interconnected with the heat dissipation fan mount; the heat dissipation port is set on the top plate of the housing; the heat dissipation fan blows air into the inner cavity of the hard housing or pumps air out of the inner cavity of the hard housing; the air flows out of the inner cavity of the hard housing or flows into the inner cavity of the hard housing via the heat dissipation port on the top plate of the hard housing.

10. The hydrogen fuel cell according to claim 1, characterized in that the hard housing for encapsulating the fuel cell stack assembly comprises a gland, two concave-shaped plates, a top plate, a bottom plate, a side plate and a flange plate;

the two concave-shaped plates are set oppositely, one end of a concave-shaped plate is fixedly connected with the side plate and the other end is fixed with the gland through the flange plate;

power source interfaces of two kinds of polarities are set on the gland and the side plate, respectively;

the gland is provided with a fuel gas inlet and the side plate is provided with a fuel gas outlet.

11. The hydrogen fuel cell according to claim 1, characterized in that the cell pack comprises a plurality of individual cells connected in series, each of the individual cells comprises an anode guide plate, a membrane electrode and a cathode guide plate;

the front of the anode guide plate and the front of the cathode guide plate are adjacent to two side surfaces of the membrane electrode, respectively; the back of the anode guide plate is adjacent to the cathode guide plate of another unit cell; the back of the cathode guide plate is adjacent to the anode guide plate of another unit cell;

the anode guide plate is provided with a main hydrogen gas inlet and a main hydrogen gas outlet, the front of the anode guide plate is provided with a hydrogen guide groove and the back is provided with a first air inlet gas distribution nozzle and a first air inlet groove interconnected with the first air inlet gas distribution nozzle; the back of the anode guide plate is further provided with a first heat dissipation groove and a first air exhaust groove;

the cathode guide plate is provided with a main hydrogen gas inlet and a main

hydrogen gas outlet, the front of the cathode guide plate is provided with an air inlet, an air outlet and an air guide groove, and the back is provided with a second air inlet gas distribution nozzle and a second air inlet groove interconnected with the second air inlet gas distribution nozzle; when the cathode guide plate is matched with another anode guide plate, the first air inlet gas distribution nozzle and the second air inlet gas distribution nozzle form a complete air inlet gas distribution nozzle, and the first air inlet groove and the second air inlet groove form a complete air inlet channel; the air inlet on the front of the cathode guide plate is set in the air inlet channel;

the back of the cathode guide plate is further provided with a second head dissipation groove and a second air exhaust groove; the air outlet on the front of the cathode guide plate is interconnected with the second air exhaust groove on the back of the cathode guide plate;

the main hydrogen gas inlets and the main hydrogen gas outlets of all the unit cells in the cell pack is interconnected with each other, and the main hydrogen gas inlets on all unit cells in the cell pack connected with an external hydrogen gas source via a hole set on the housing;

the air inlet gas distribution nozzle on each unit cell in the cell pack is respectively interconnected with the gas flow outlet of the outside plate gas distribution device for working gas flow ;

the first heat dissipation groove on the back of the anode guide plate and the second heat dissipation groove on the back of the cathode guide plate are combined into a heat dissipation channel;

the second air exhaust groove on the back of the cathode guide plate and the first air exhaust groove on the back of the anode are combined into an exhaust gas channel;

preferably, there are one or more exhaust gas channels.

12. The hydrogen fuel cell according to claim 11, characterized in that the anode guide plate is a guide plate with double gas inlets at the two sides and gas outlet in the middle; there are two main hydrogen gas inlets set at the two sides of the anode guide plate, respectively, and there is one main hydrogen gas outlet set in the middle of the anode guide plate; hydrogen enters into the anode guide plate through the two sides of the

anode guide plate, flows from the two sides towards the middle and is exhausted from the main hydrogen gas outlet in the middle;

the cathode guide plate is a guide plate with gas inlet in the middle and double gas outlets at the two sides; air enters the air inlet from the air inlet channel in the middle of the cathode guide plate, flows from the middle towards the two sides and is exhausted from the exhaust gas channels at the two sides.

13. The hydrogen fuel cell according to claim 11, characterized in that the anode guide plate is provided with one main hydrogen gas inlet set on one side of the anode guide plate and there is one main hydrogen gas outlet set on the other side of the anode guide plate.

14. The hydrogen fuel cell according to claim 12or claim 13, characterized in that the two ends of the hydrogen guide groove on the front of the anode guide plate are provided with a first gas guide hole and a second gas guide hole; the first gas guide hole is on the back of the anode guide plate and interconnected with the main hydrogen gas inlet; the second gas guide hole is on the back of the anode guide plate and interconnected with the main hydrogen gas outlet.

15. The hydrogen fuel cell according to claim 11, claim 12or claim 13, characterized in that the hydrogen guide groove is arranged longitudinally and the air guide groove is arranged transversely.

16. The hydrogen fuel cell according to claim 11, characterized in that the back of the anode guide plate and the back of the cathode guide plate are provided with a plurality of reinforcing ribs.

17. The hydrogen fuel cell according to claim 16, characterized in that the reinforcing ribs form a turbulator in the first heat dissipation groove and the second heat dissipation groove.

18. The hydrogen fuel cell according to any one of claims 1 to 13 or claim 16 or claim 17, characterized in that a plurality of fuel cell stack assemblies are encapsulated by the hard housing and are integrated together as a whole composite structure; more than two groups of the fuel cell stack assemblies are connected in series; the power supply plates at the head and the end of the fuel cell stack assemblies connected in series are

respectively connected with two power source interfaces with opposite polarities on the hard housing;

preferably, when the fuel cell stack assemblies are set in parallel in the inner cavity of the housing, the outside plate gas distribution device for working gas flow further comprises a gas flow distribution pipe; the gas flow distribution pipe comprises a gas flow inlet and more than two gas flow distribution ports; the gas flow inlet is interconnected with the working fan; the number of the gas flow distribution ports is matched with the number of fuel cell stacks in parallel assemblies.

19. A method for dynamic variable humidity control of a hydrogen fuel cell system, characterized in that a membrane electrode of the hydrogen fuel cell system is composed of a proton membrane, two catalyst layers and two diffusion layers, wherein the two catalyst layers are set on two sides of the proton membrane, and the two diffusion layers are set on two outsides of each catalyst layer; the flow rate of the working gas flow is changed repeatedly according to a certain time interval and increment, so that the proton membrane works in a relatively high humidity R1 and the catalyst layers work under a medium humidity R2 during a dynamic adjustment process while the working humidity R3 of the diffusion layers is always circulated and repeated in a relatively low humidity, wherein R1>R2>R3.

20. The method for dynamic variable humidity control of the hydrogen fuel cell system according to claim 19, characterized in that the increment is 5% to 30% of the starting flow rate and the time interval is 1 to 30 minutes.

Claims

1. A hydrogen fuel cell, characterized in that it comprises a fuel cell stack assembly and an outside plate gas distribution device;

the fuel cell stack assembly comprises a first insulating plate, a first power supply plate, a cell pack, a second power supply plate and a second insulating plate set in series; the first power supply plate and the second power supply plate function as the anode output and the cathode output of the cell pack, respectively;

the fuel cell stack assembly is encapsulated with a hard housing;

the outside plate gas distribution device is fixed on the hard housing; the outside plate gas distribution device comprises an outside plate gas distribution device for working gas flow and a heat dissipation gas distribution device; the outside plate gas distribution device for working gas flow is provided with a fan mount for connecting with a working fan, and the outside plate gas distribution device for working gas flow extends into the inner cavity of the hard housing from outside of the hard housing; the gas flow outlet of the outside plate gas distribution device for working gas flow is connected with the air inlet gas distribution nozzle of each unit cell in the cell pack;

the heat dissipation gas distribution device comprises a heat dissipation channel set outside the hard housing and interconnected with the inner cavity of the hard housing, and a heat dissipation port set on the hard housing; the heat dissipation channel is provided with a heat dissipation fan mount for connecting with a heat dissipation fan;

the hard housing for encapsulating the fuel cell stack assembly comprises a gland, two concave-shaped plates, a top plate, a bottom plate, a side plate and a flange plate;

the two concave-shaped plates are set oppositely, one end of a concave-shaped plate is fixedly connected with the side plate and the other end is fixed with the gland through the flange plate;

power source interfaces of two kinds of polarities are set on the gland and the side plate, respectively;

the gland is provided with a fuel gas inlet and the side plate is provided with a

fuel gas outlet.

2. The hydrogen fuel cell according to claim 1, characterized in that the outside plate gas distribution device for working gas flow comprises a gas distribution manifold, a gas distribution groove and a gas flow outlet;

the gas distribution manifold is located outside the hard housing and fixed on the top plate of the hard housing; the gas distribution manifold is interconnected with the gas distribution groove; the gas distribution groove extends into the inner cavity of the hard housing; the gas flow outlet is formed on the bottom of the gas distribution groove; the gas flow outlet is interconnected with the air inlet gas distribution nozzle of each unit cell in the cell pack;

the gas distribution manifold is provided with the fan mount for connecting with the working fan.

3. The hydrogen fuel cell according to claim 2, characterized in that the outside plate gas distribution device is a single-side gas distribution device; both the outside plate gas distribution device for working gas flow and the heat dissipation gas distribution device are set on the top plate of the hard housing.

4. The hydrogen fuel cell according to claim 3, characterized in that one end of the heat dissipation channel is an open end; the open end of the heat dissipation channel is provided with the heat dissipation fan mount; the heat dissipation channel is lowered gradually towards the other end from the open end and fixed and covered on the top plate of the hard housing;

the heat dissipation fan blows air into the inner cavity of the hard housing via the heat dissipation channel to cool the fuel cell stack assembly; heat dissipation air obtained after cooling the fuel cell stack assembly is exhausted from the heat dissipation port on the hard housing.

5. The hydrogen fuel cell according to claim 4, characterized in that one end of the gas distribution manifold is an open end; the open end of the gas distribution manifold is provided with the working fan mount; the gas distribution manifold is lowered gradually towards the other end from the open end.

6. The hydrogen fuel cell according to claim 5, characterized in that the open

end of the gas distribution manifold and the open end of the heat dissipation channel are located on two opposite sides of the top plate of the hard housing, respectively.

7. The hydrogen fuel cell according to claim 4, characterized in that the inner wall of the heat dissipation channel is provided with a gas flow diversion damping groove.

8. The hydrogen fuel cell according to claim 2, characterized in that the outside plate gas distribution device is a double-side gas distribution device; the outside plate gas distribution device for working gas flow is set on the top plate of the hard housing; the heat dissipation channel of the heat dissipation gas distribution device is set on the bottom plate of the hard housing.

9. The hydrogen fuel cell according to claim 8, characterized in that the heat dissipation channel is a heat dissipation air collection chamber interconnected with the inner cavity of the hard housing; the heat dissipation air collection chamber is interconnected with the heat dissipation fan mount; the heat dissipation port is set on the top plate of the housing; the heat dissipation fan blows air into the inner cavity of the hard housing or pumps air out of the inner cavity of the hard housing; the air flows out of the inner cavity of the hard housing or flows into the inner cavity of the hard housing via the heat dissipation port on the top plate of the hard housing.

10. The hydrogen fuel cell according to claim 1, characterized in that the cell pack comprises a plurality of individual cells connected in series, each of the individual cells comprises an anode guide plate, a membrane electrode and a cathode guide plate;

the front of the anode guide plate and the front of the cathode guide plate are adjacent to two side surfaces of the membrane electrode, respectively; the back of the anode guide plate is adjacent to the cathode guide plate of another unit cell; the back of the cathode guide plate is adjacent to the anode guide plate of another unit cell;

the anode guide plate is provided with a main hydrogen gas inlet and a main hydrogen gas outlet, the front of the anode guide plate is provided with a hydrogen guide groove and the back is provided with a first air inlet gas distribution nozzle and

a first air inlet groove interconnected with the first air inlet gas distribution nozzle; the back of the anode guide plate is further provided with a first heat dissipation groove and a first air exhaust groove;

the cathode guide plate is provided with a main hydrogen gas inlet and a main hydrogen gas outlet, the front of the cathode guide plate is provided with an air inlet, an air outlet and an air guide groove, and the back is provided with a second air inlet gas distribution nozzle and a second air inlet groove interconnected with the second air inlet gas distribution nozzle; when the cathode guide plate is matched with another anode guide plate, the first air inlet gas distribution nozzle and the second air inlet gas distribution nozzle form a complete air inlet gas distribution nozzle, and the first air inlet groove and the second air inlet groove form a complete air inlet channel; the air inlet on the front of the cathode guide plate is set in the air inlet channel;

the back of the cathode guide plate is further provided with a second head dissipation groove and a second air exhaust groove; the air outlet on the front of the cathode guide plate is interconnected with the second air exhaust groove on the back of the cathode guide plate;

the main hydrogen gas inlets and the main hydrogen gas outlets of all the unit cells in the cell pack is interconnected with each other, and the main hydrogen gas inlets on all unit cells in the cell pack connected with an external hydrogen gas source via a hole set on the housing;

the air inlet gas distribution nozzle on each unit cell in the cell pack is respectively interconnected with the gas flow outlet of the outside plate gas distribution device for working gas flow ;

the first heat dissipation groove on the back of the anode guide plate and the second heat dissipation groove on the back of the cathode guide plate are combined into a heat dissipation channel;

the second air exhaust groove on the back of the cathode guide plate and the first air exhaust groove on the back of the anode are combined into an exhaust gas channel;

preferably, there are one or more exhaust gas channels.

11. The hydrogen fuel cell according to claim 10, characterized in that the anode guide plate is a guide plate with double gas inlets at the two sides and gas outlet in the middle; there are two main hydrogen gas inlets set at the two sides of the anode guide plate, respectively, and there is one main hydrogen gas outlet set in the middle of the anode guide plate; hydrogen enters into the anode guide plate through the two sides of the anode guide plate, flows from the two sides towards the middle and is exhausted from the main hydrogen gas outlet in the middle;

the cathode guide plate is a guide plate with gas inlet in the middle and double gas outlets at the two sides; air enters the air inlet from the air inlet channel in the middle of the cathode guide plate, flows from the middle towards the two sides and is exhausted from the exhaust gas channels at the two sides.

12. The hydrogen fuel cell according to claim 10, characterized in that the anode guide plate is provided with one main hydrogen gas inlet set on one side of the anode guide plate and there is one main hydrogen gas outlet set on the other side of the anode guide plate.

13. The hydrogen fuel cell according to claim 11 or claim 12, characterized in that the two ends of the hydrogen guide groove on the front of the anode guide plate are provided with a first gas guide hole and a second gas guide hole; the first gas guide hole is on the back of the anode guide plate and interconnected with the main hydrogen gas inlet; the second gas guide hole is on the back of the anode guide plate and interconnected with the main hydrogen gas outlet.

14. The hydrogen fuel cell according to claim 10, claim 11 or claim 12, characterized in that the hydrogen guide groove is arranged longitudinally and the air guide groove is arranged transversely.

15. The hydrogen fuel cell according to claim 10, characterized in that the back of the anode guide plate and the back of the cathode guide plate are provided with a plurality of reinforcing ribs.

16. The hydrogen fuel cell according to claim 15, characterized in that the reinforcing ribs form a turbulator in the first heat dissipation groove and the second

heat dissipation groove.

17. The hydrogen fuel cell according to any one of claims 1 to 12 or claim 15 or claim 16, characterized in that a plurality of fuel cell stack assemblies are encapsulated by the hard housing and are integrated together as a whole composite structure; more than two groups of the fuel cell stack assemblies are connected in series; the power supply plates at the head and the end of the fuel cell stack assemblies connected in series are respectively connected with two power source interfaces with opposite polarities on the hard housing;

preferably, when the fuel cell stack assemblies are set in parallel in the inner cavity of the housing, the outside plate gas distribution device for working gas flow further comprises a gas flow distribution pipe; the gas flow distribution pipe comprises a gas flow inlet and more than two gas flow distribution ports; the gas flow inlet is interconnected with the working fan; the number of the gas flow distribution ports is matched with the number of fuel cell stacks in parallel assemblies.

18. A method for dynamic variable humidity control of a hydrogen fuel cell system, characterized in that a membrane electrode of the hydrogen fuel cell system is composed of a proton membrane, two catalyst layers and two diffusion layers, wherein the two catalyst layers are set on two sides of the proton membrane, and the two diffusion layers are set on two outsides of each catalyst layer; the flow rate of the working gas flow is changed repeatedly according to a certain time interval and increment, so that the proton membrane works in a relatively high humidity R1 and the catalyst layers work under a medium humidity R2 during a dynamic adjustment process while the working humidity R3 of the diffusion layers is always circulated and repeated in a relatively low humidity, wherein R1>R2>R3.

19. The method for dynamic variable humidity control of the hydrogen fuel cell system according to claim 18, characterized in that the increment is 5% to 30% of the starting flow rate and the time interval is 1 to 30 minutes.