Claims

What is claimed is:

1. A zinc-air fuel cell with multiple electric connectors, comprising:

a case forming a space that is internal to the zinc-air fuel cell;

a plurality of gas chambers disposed in the space;

two air electrode layers disposed in the space and serving as positive electrodes for discharging in a chemical reaction;

a metal layer disposed in the space and serving as a positive electrode for charging in the chemical reaction;

a zinc material disposed in the space and serving as a negative electrode to go with the air electrode layers for discharging in the chemical reaction or a negative electrode to go with the metal layer for charging in the chemical reaction;

a plurality of separators disposed in the space, respectively disposed between the air electrode layers and the metal layer so that the air electrode layers, the zinc material and the metal layer are separately arranged; and

an electrolyte disposed in the space, the electrolyte capable of flowing to pass through the separators and in contact with the air electrode layers, with the metal layer and with the zinc material so that the air electrode layers, the zinc material and the metal layer are respectively electrically connected,

wherein the electrolyte is disposed in the space via at least one of the plurality of gas chambers that are configured to pass but not to hold the electrolyte, and

wherein the electrolyte is disposed in the space up to a level that is located lower than the plurality of gas chambers.

2. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the case comprising a polyarysulfone material and formed by an insert molding method to prevent the electrolyte from leaking.

3. The zinc-air fuel cell with multiple electric connectors of Claim 1, further comprising:

a transport device connected to the space to regulate a height of the electrolyte in the space.

4. The zinc-air fuel cell with multiple electric connectors of Claim 3, wherein the transport device regulates either or both of input of the electrolyte into the space and output of the electrolyte from the space.

5. The zinc-air fuel cell with multiple electric connectors of Claim 3, wherein the transport device regulates either or both of input and output of a gas into the space.

6. The zinc-air fuel cell with multiple electric connectors of Claim 3, wherein the zinc-air fuel cell with multiple electric connectors is activated for a charge reaction or for a discharge reaction when the height of the electrolyte in the space enables the electrolyte in contact with the air electrode layers, with the metal layer and with the zinc material simultaneously.

7. The zinc-air fuel cell with multiple electric connectors of Claim 3, wherein the zinc-air fuel cell with multiple electric connectors is activated for a discharge reaction when the height of the electrolyte in the space enables the electrolyte in contact with the air electrode layers and with the zinc material simultaneously.

8. The zinc-air fuel cell with multiple electric connectors of Claim 3, wherein the zinc-air fuel cell with multiple electric connectors is activated for a charge reaction when the height of the electrolyte in the space enables the electrolyte in contact with the metal layer and with the zinc material simultaneously.

9. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the zinc-air fuel cell with multiple electric connectors is deactivated for a chemical reaction when the electrolyte is in contact with one of the air electrode layers, the metal layer and the zinc material.

10. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the gas chambers buffer a circulation of a gas or the electrolyte.

11. The zinc-air fuel cell with multiple electric connectors of Claim 1, further comprising:

two conductive layers, disposed on two sides of the space to be adjacent to and in contact with the zinc material to accommodate the zinc material.

12. The zinc-air fuel cell with multiple electric connectors of Claim 11, wherein at least one of the conductive layers has a peripheral region and a central region, and wherein the central region is lower than the peripheral region to form a recess to accommodate the zinc material.

13. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the zinc material comprises flowable zinc slurry, zinc particles or a zinc plate.

14. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the air electrode layers comprise a first air electrode layer and a second air electrode layer, and wherein the first air electrode layer, the metal layer, the zinc material and the second air electrode layer are vertically arranged.

15. The zinc-air fuel cell with multiple electric connectors of Claim 14, wherein the first air electrode layer is a topmost

layer, the zinc material is a bottommost layer, and the metal layer is disposed between the first air electrode layer and the zinc material.

16. The zinc-air fuel cell with multiple electric connectors of Claim 1, wherein the zinc material comprises a first negative electrode and a second negative electrode, wherein the air electrode layers comprise a first positive electrode and a second positive electrode, and wherein the first negative electrode and the second negative electrode are disposed between the first positive electrode and the second positive electrode for charging in the chemical reaction.

17. The zinc-air fuel cell with multiple electric connectors of claim 1, wherein the plurality of gas chambers are mutually connected.

18. The zinc-air fuel cell with multiple electric connectors of claim 1, further comprising:

one or more guide columns, each disposed between two adjacent gas chambers of the plurality of gas chambers to guide a circulation of at least one of the zinc material, the electrolyte, and a gas.

19. The zinc-air fuel cell with multiple electric connectors of claim 1, wherein the plurality of gas chambers are configured to balance an internal pressure of the zinc-air fuel cell.

20. The zinc-air fuel cell with multiple electric connectors of claim 1, wherein each of the air electrode layers comprises a metal mesh, a waterproof and breathable layer and a catalytic layer.