CLAIMS

WHAT IS CLAIMED IS:

1. An integrated electrode frame, comprising a positive electrode frame, a negative electrode frame, and a membrane, wherein

each of the positive electrode frame and the negative electrode frame is a flat plate with a central through-hole;

the membrane is placed between the positive electrode frame and the negative electrode frame, and the membrane is located at the through-hole and hermetically connected to a peripheral edge of the through-hole;

a peripheral edge of the positive electrode frame is hermetically connected to a peripheral edge of the negative electrode frame; and material compositions of at least the connection portions of the positive electrode frame and the negative electrode frame contain at least one same substance;

wherein the membrane is non-transparent or transparent; and one of the positive electrode frame and the negative electrode frame is transparent, and the other of the positive electrode frame and the negative electrode frame is non-transparent;

wherein a laser transmittance of the transparent electrode frame is 20% or above; a laser transmittance of the non-transparent electrode frame is 5% or below; and a difference of the laser transmittance between the transparent electrode frame and the non-transparent electrode frame is 15-100%;

wherein a content of the same material accounts for 10% or more of a total weight of the material composition of respective structure.

2. The integrated electrode frame according to claim 1, wherein the same material is at least one selected from the group consisting of polypropylene (PP), polyethylene (PE), polystyrene (PS), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polymethyl methacrylate (PMMA), and polyethylene terephthalate (PET).

3. The integrated electrode frame according to claim 1, wherein the positive electrode frame and the negative electrode frame have same shape and size; and

a size of the membrane is smaller than a size of the positive electrode frame and a size of the negative electrode frame.

4. The integrated electrode frame according to claim 3, wherein the positive electrode frame or the negative electrode frame has an encircling step around the through-hole; and the membrane is located on the encircling step, and is hermetically connected to the encircling step.

5. The integrated electrode frame according to claim 1, wherein

if the membrane which is hermetically connected to the positive electrode frame is non-transparent, the positive electrode frame is transparent, and the negative electrode frame is non-transparent;

if the membrane which is hermetically connected to the positive electrode frame is transparent, the positive electrode frame is non-transparent, and the negative electrode frame is transparent;

material compositions of at least the connection portions of the membrane and the positive electrode frame contain at least one same material; and

the same material is at least one selected from the group consisting of PP, PE, PS, PC, ABS, PMMA, and PET.

6. The integrated electrode frame according to claim 1, wherein

the laser transmittance of the transparent electrode frame is 40% or above;

the laser transmittance of the non-transparent electrode frame is 1% or below; and

the difference of the laser transmittance between the transparent electrode frame and the non-transparent electrode frame is 35-100%.

7. The integrated electrode frame according to claim 1, wherein the transparent material comprises at least one selected from the group consisting of PP, PE, PS, PC, ABS, PMMA, and PET; and

the non-transparent material comprises the transparent material and a toner.

8. The integrated electrode frame according to claim 7, wherein

the toner is at least one selected from the group consisting of a black toner, a yellow toner, a tan toner, a brown toner, and a dark blue toner; and

the transparent material further comprises a white toner.

9. The integrated electrode frame according to claim 1, wherein the membrane has a thickness of 100 μm to 3 mm, a porosity of 40-90%, and a pore size of 1-300 nm.

10. The integrated electrode frame according to claim 1, wherein a content of the same material accounts for 40% or more of a total weight of the material composition of respective structure.

11. The integrated electrode frame according to claim 1, wherein the flat plate has a fluid distribution channel.

12. A method for preparing the integrated electrode frame according to any one of claims 1 to 11, comprising at least the following steps:

covering the membrane on a surface of one of the positive electrode frame and the negative electrode frame where the through-hole is formed, and hermetically connecting the membrane with the peripheral edge of the through-hole to form a membrane-bonded electrode frame; and

laminating the other of the positive electrode frame and the negative electrode frame with the membrane-bonded electrode frame, and hermetically connecting a peripheral edge of the other of the positive electrode frame and the negative electrode frame with a peripheral edge of the membrane-bonded electrode frame, wherein the membrane is located between the positive electrode frame and the negative electrode frame to form the integrated electrode frame

wherein hermetical connection is implemented by laser welding;

wherein the membrane is hermetically connected to the peripheral edge of the through-hole by laser welding with a welding power of 2-50 W and a welding speed of 2-20 mm/s; and the peripheral edges of the electrode frames are hermetically connected by laser welding with a welding power of 15-300 W and a welding speed of 5-50 mm/s.

13. The method according to claim 12, wherein when the membrane is transparent, the method comprises:

covering the membrane on the surface of a non-transparent electrode frame where the through-hole is formed, and hermetically connecting the membrane with the peripheral edge of the through-hole to form a membrane-bonded non-transparent electrode frame; and

laminating a transparent electrode frame with the membrane-bonded non-transparent electrode frame, and hermetically connecting a peripheral edge of the transparent electrode frame with a peripheral edge of the membrane-bonded non-transparent electrode frame, wherein the membrane is located between the transparent electrode frame and the non-transparent electrode frame to form the integrated electrode frame; and

alternatively, when the membrane is non-transparent, the method comprises:

covering the membrane on the surface of the transparent electrode frame where the through-hole is formed, and hermetically connecting the membrane with the peripheral edge of the through-hole to form a membrane-bonded transparent electrode frame; and

laminating the non-transparent electrode frame with the membrane-bonded transparent electrode frame, and hermetically connecting a peripheral edge of the non-transparent electrode frame with a peripheral edge of the membrane-bonded transparent electrode frame, wherein the membrane is located between the non-transparent electrode frame and the transparent electrode frame to form the integrated electrode frame.