WE CLAIM

1. An electro-osmotic pump, comprising:

a membrane that allows fluid movement; and

a first electrode and a second electrode respectively provided on both sides of the membrane,

wherein the first electrode and the second electrode are electrodes comprising a plate-shaped substrate made of an impermeable substrate material, an electrode material coated thereon and at least one fluid pathway formed in the substrate,

the impermeable substrate material includes at least one of a conducting material, a semiconducing material and a non-conducting material,

wherein the conducting material includes at least one selected from carbon, gold, ruthenium, palladium, zinc, platinum, cobalt, lead, manganese, tin, iridium, iron, gold oxide, silver oxide, ruthenium oxide, platinum oxide, lead oxide, iridium oxide, polypyrroles, polypyrrole derivatives, polyanilines, polyaniline derivatives, polythiophenes, polythiophene derivatives, and combinations thereof,

wherein the semiconducing material includes at least one selected from Sn, SiC, Ge, Se, AlP, AlAs, AlSb, GaP, GaAs, InP, InAs, InSb, ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, ZnO, SnO_2, SiO_2, CeO_2, TiO_2, WO_3, Fe_2O_3, In_2O_3, CuO, polypyrroles, polypyrrole derivatives, polyaniline, polyaniline derivatives, polythiophenes, polythiophene derivatives, Prussian blue, iron hexacyanoferrate (FeHCF), copper hexacyanoferrate (CuHCF), cobalt hexacyanoferrate (CoHCF), nickel hexacyanoferrate, and combinations thereof, and

wherein the non-conducting material includes at least one selected from ethylenevinylalcohol, polyethylene terephthalate, poly(methyl methacrylate), polycarbonate, polyethylene sulfone, polyolefine, polyamide, polyester, aramid, acryl, polyethylene oxide, polycaprolactone, polycarbonate,

polyurethane, polystyrene, polybezimidazole, poly(2-hydroxyethyl methacrylate), poly(ether imide), styrene-butadiene-styrene block copolymer, poly(ferrocenyldimethylsilane), and combinations thereof.

2. The electro-osmotic pump of Claim 1,

wherein the conducting material further includes at least one selected from nickel, copper, silver, titanium, aluminum, and combinations thereof.

3. The electro-osmotic pump of Claim 1,

wherein the semiconducing material further includes Si.

4. The electro-osmotic pump of Claim 1,

wherein the non-conducting material further includes at least one selected from polyethylene, polypropylene, polyvinylidene fluoride, polyvinylidene chloride, polyimide, and combinations thereof.

5. The electro-osmotic pump of Claim 1,

wherein the electrode material includes at least one selected from metals, metal oxides, conducting polymers, metal hexacyanoferrates, carbon nanostructures and composites thereof.

6. The electro-osmotic pump of Claim 5,

wherein the metals include at least one of silver, zinc, lead, manganese, copper, tin, ruthenium, nickel, gold, titanium, palladium, platinum, cobalt, iron, aluminum, iridium and combinations thereof.

7. The electro-osmotic pump of Claim 5,

wherein the metal oxides include at least one of vanadium oxide, molybdenum oxide (MoO_3), tungsten oxide (WO_3), ruthenium oxide, iridium oxide, manganese oxide, cerium oxide (CeO_2), silver oxide, platinum oxide, lead oxide, polyoxometalate and combinations thereof.

8. The electro-osmotic pump of Claim 5,

wherein the conducting polymers include at least one of polyaniline, polyaniline derivatives, polythiophene, polythiophene derivatives, polypyrrole, polypyrrole derivatives, quinone polymers, quinone polymer derivatives, polythionine and combinations thereof.

9. The electro-osmotic pump of Claim 5,

wherein the metal hexacyanoferrates include at least one of Prussian blue, iron hexacyanoferrate (FeHCF), copper hexacyanoferrate (CuHCF), cobalt hexacyanoferrate (CoHCF), nickel hexacyanoferrate (NiHCF) and combinations thereof.

10. The electro-osmotic pump of Claim 5,

wherein the carbon nanostructures include at least one of carbon nanotube (CNT), graphene, carbon nanoparticle, fullerene, graphite and combinations thereof.

11. The electro-osmotic pump of Claim 1,

wherein each of the surface of the electrode material in the first electrode or the second electrode is independently smoothly processed by thermos-compression or decal transfer.

12. The electro-osmotic pump of Claim 1,

wherein, in the first electrode and/or the second electrode, the ratio of the area of the fluid pathway to the total area of the electrodes is greater than 0% to 50% or less.

13. The electro-osmotic pump of Claim 1, further comprising:

frames that support the first electrode and the second electrode on both sides thereof respectively, and have a fluid pathway.

14. The electro-osmotic pump of Claim 1, further comprising:

a power supply that supplies a voltage to the first electrode and the second electrode.

15. The electro-osmotic pump of Claim 1,

wherein a voltage with alternating polarities is supplied to each of the first electrode and the second electrode and repeated electrochemical reactions occur in forward and reverse directions, and thus, a pumping force is generated by a repeated reciprocating movement of the fluid.

16. The electro-osmotic pump of Claim 15,

wherein each of the first electrode and the second electrode is repeatedly consumed and regenerated by the repeated electrochemical reactions in forward and reverse directions.

17. A method of manufacturing an electrode that constitutes an electro-osmotic pump, comprising:

forming at least one fluid pathway in a plate-shaped substrate made of an impermeable substrate material and coating an electrode material on the substrate to obtain an electrode; or

coating an electrode material on a plate-shaped substrate made of an impermeable substrate material and forming at least one fluid pathway in the substrate to obtain an electrode,

wherein the impermeable substrate material includes at least one of a conducting material, a semiconducing material and a non-conducting material,

wherein the conducting material includes at least one selected from carbon, gold, ruthenium, palladium, zinc, platinum, cobalt, lead, manganese, tin, iridium, iron, gold oxide, silver oxide, ruthenium oxide, platinum oxide, lead oxide, iridium oxide, polypyrroles, polypyrrole derivatives, polyanilines, polyaniline derivatives, polythiophenes, polythiophene derivatives, and combinations thereof,

wherein the semiconducing material includes at least one selected from Sn, SiC, Ge, Se, AlP, AlAs, AlSb, GaP, GaAs, InP, InAs, InSb, ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, ZnO, SnO2, SiO2, CeO2, TiO2, WO3, Fe2O3, In2O3, CuO, polypyrroles, polypyrrole derivatives, polyaniline, polyaniline derivatives, polythiophenes, polythiophene derivatives, Prussian blue, iron hexacyanoferrate (FeHCF), copper hexacyanoferrate (CuHCF), cobalt hexacyanoferrate (CoHCF), nickel hexacyanoferrate, and combinations thereof, and

wherein the non-conducting material includes at least one selected from ethylenevinylalcohol, polyethylene terephthalate, poly(methyl methacrylate), polycarbonate, polyethylene sulfone, polyolefine, polyamide, polyester, aramid, acryl, polyethylene oxide, polycaprolactone, polycarbonate,

polyurethane, polystyrene, polybezimidazole, poly(2-hydroxyethyl methacrylate), poly(ether imide), styrene-butadiene-styrene block copolymer, poly(ferrocenyldimethylsilane), and combinations thereof.

18. The method of manufacturing an electrode of Claim 17,

wherein the electro-osmotic pump includes:

a membrane that allows fluid movement; and

a first electrode and a second electrode respectively provided on both sides of the membrane,

the first electrode and the second electrode are manufactured by the method of claim 17.

19. The method of manufacturing an electrode of Claim 17,

Wherein in the coating process, the electrode material is coated by at least one method of drop-coating, dip-coating, spin-coating, spray-coating, printing, pyrolysis and electroplating.