CLAIMS

1. A bio-electrode comprising:

a porous, stretchy base material;

an adhesive, conductive film containing silicon; and

a conducting path,

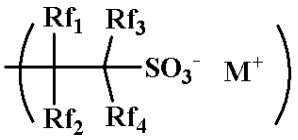
wherein the conductive film is formed on one surface of the porous, stretchy base material,

the conducting path is connected to the conductive film, and penetrates the stretchy base material to be exposed on the opposite side, or is exposed on a side surface of the stretchy base material,

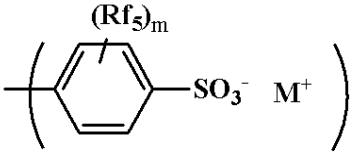
wherein the adhesive, conductive film containing silicon contains an ionic material (A) selected from the group consisting of salts of ammonium, lithium, sodium, and potassium formed with any of fluorosulfonic acid, fluorosulfonimide, and N-carbonylfluorosulfonic amide.

2. The bio-electrode according to claim 1, wherein the porous, stretchy base material is a non-woven fabric or a membrane film.

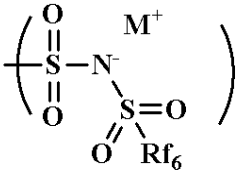
3. The bio-electrode according to claim 1 or 2, wherein the ionic material (A) has a partial structure shown by the following general formulae (1)-1 to (1)-4,



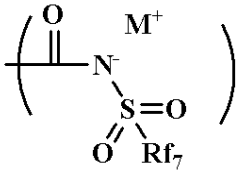
(1)-1



(1)-2



(1)-3

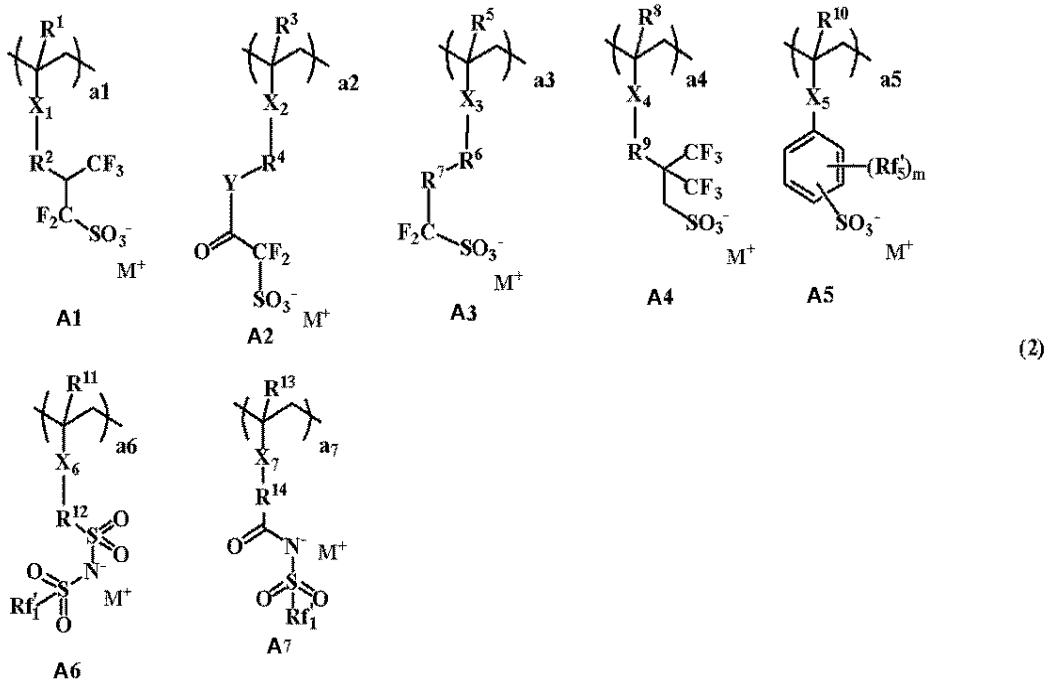


(1)-4

wherein Rf_1 and Rf_2 each represent a hydrogen atom, a fluorine atom, an oxygen atom, a methyl group, or a trifluoromethyl group, provided that when Rf_1 and Rf_2 represent an oxygen atom, the single oxygen atom represented by Rf_1 and Rf_2 bonds to a single carbon atom to form a carbonyl group; Rf_3 and Rf_4 each represent a hydrogen atom, a fluorine atom, or a trifluoromethyl group, provided that at least one of Rf_1 to Rf_4 is a fluorine atom or a trifluoromethyl group; Rf_5, Rf_6, and Rf_7 each represent a fluorine atom, a trifluoromethyl group, or a linear or branched alkyl group having 1 to 4 carbon atoms, and have at least one fluorine atom; M^+ represents an ion selected from the group consisting of an ammonium ion, a sodium ion, and a potassium ion; and

“m” represents an integer of 1 to 4.

4. The bio-electrode according to any one of claims 1 to 3, wherein the ionic material (A) comprises at least one ionic polymer selected from the group consisting of repeating units A1 to A7 shown by the following general formula (2),

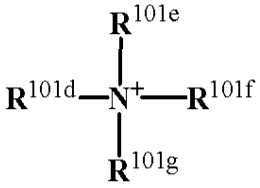


(2)

wherein R^1, R^3, R^5, R^8, R^{10}, R^{11}, and R^{13} each independently represent a hydrogen atom or a methyl group; R^2, R^4, R^6, R^9, R^{12}, and R^{14} each independently represent a single bond, or a linear, branched, or cyclic hydrocarbon group having 1 to 13 carbon atoms, the hydrocarbon group optionally having either or both of an ester group and an ether group; R^7 represents a linear or branched alkylene group having 1 to 4 carbon atoms, and one or two hydrogen atoms in R^7 are optionally substituted with a fluorine atom; X_1, X_2, X_3, X_4, X_6 and X_7 each independently represent any of a single bond, a phenylene group, a naphthylene group, an

ether group, an ester group, and an amide group; X_5 represents any of a single bond, an ether group, and an ester group; Y represents any of an oxygen atom and a $-NR^{19}-$ group; R^{19} represents any of a hydrogen atom, a linear, branched, or cyclic alkyl group having 2 to 12 carbon atoms, and a phenyl group, and optionally have one or more selected from the group consisting of an ether group, a carbonyl group, an ester group, and an amide group; Y optionally forms a ring together with R^4; Rf_1' and Rf_5' each represent a fluorine atom, a trifluoromethyl group, or a linear or branched alkyl group having 1 to 4 carbon atoms, and have at least one fluorine atom; "m" represents an integer of 1 to 4; a1, a2, a3, a4, a5, a6, and a7 are $0 \leq a1 \leq 1.0$, $0 \leq a2 \leq 1.0$, $0 \leq a3 \leq 1.0$, $0 \leq a4 \leq 1.0$, $0 \leq a5 \leq 1.0$, $0 \leq a6 \leq 1.0$, $0 \leq a7 \leq 1.0$, and $0 < a1+a2+a3+a4+a5+a6+a7 \leq 1.0$; M^+ represents an ion selected from the group consisting of an ammonium ion, a sodium ion, and a potassium ion.

5. The bio-electrode according to any one of claims 1 to 4, wherein the ionic material (A) comprises an ammonium ion shown by the following general formula (3) as an ammonium ion for forming the ammonium salts,



(3)

wherein R^{101d}, R^{101e}, R^{101f}, and R^{101g} each represent a hydrogen atom, a linear, branched, or cyclic alkyl group having 1 to 15 carbon atoms, a linear, branched, or cyclic alkenyl group or alkynyl group having 2 to 12 carbon atoms, or an aromatic group having 4 to 20 carbon

atoms, and optionally have one or more selected from the group consisting of an ether group, a carbonyl group, an ester group, a hydroxy group, an amino group, a nitro group, a sulfonyl group, a sulfinyl group, a halogen atom, and a sulfur atom; and R^{101d} and R^{101e}, or R^{101d}, R^{101e}, and R^{101f}, are optionally bonded to each other together with a nitrogen atom bonded therewith to form a ring in which R^{101d} and R^{101e}, or R^{101d}, R^{101e}, and R^{101f}, represent an alkylene group having 3 to 10 carbon atoms, or to form a heteroaromatic ring having the nitrogen atom in the general formula (3) within the ring.

6. The bio-electrode according to any one of claims 1 to 5, further comprising, in addition to the component (A), an adhesive resin as a component (B) that is different from the component (A), which is one or more selected from the group consisting of a silicone resin, a (meth) acrylate resin, and a urethane resin.

7. The bio-electrode according to claim 6, wherein the component (B) comprises a diorganosiloxane having an alkenyl group and an organohydrogenpolysiloxane having a SiH group.

8. The bio-electrode according to claim 6 or 7, wherein the component (B) further comprises a silicone resin having an SiO_2 unit and an $R_xSiO_{(4-x)/2}$ unit, wherein R represents a substituted or unsubstituted monovalent hydrocarbon group having 1 to 10 carbon atoms, and “x” represents a number in a range of 2.5 to 3.5.

9. The bio-electrode according to any one of claims 1 to 8, further comprising a component (C), which is one

or more selected from the group consisting of a carbon powder, a metal powder, a silicon powder, and a lithium titanate powder.

10. The bio-electrode according to claim 9, wherein the carbon powder is one or both of carbon black and carbon nanotube.

11. The bio-electrode according to any one of claims 1 to 10, wherein the conducting path comprises one or more selected from the group consisting of gold, silver, silver chloride, platinum, aluminum, magnesium, tin, tungsten, iron, copper, nickel, stainless steel, chromium, titanium, carbon, and a conductive polymer.

12. The bio-electrode according to any one of claims 1 to 11, wherein the conducting path has a snap shape.

13. The bio-electrode according to any one of claims 1 to 12, wherein a total film thickness of the stretchy base material and the conductive film in combination is 1 mm or less.

14. The bio-electrode according to claim 13, wherein the total film thickness of the stretchy base material and the conductive film in combination is 500 μm or less.

15. The bio-electrode according to any one of claims 1 to 14, wherein the stretchy base material includes an adhesive layer.

16. The bio-electrode according to any one of claims 1 to 15, wherein a top of the conductive film is covered

with a release liner.

17. The bio-electrode according to claim 16, wherein the release liner is selected from the group consisting of a fluorine resin, polyethylene, polypropylene, cyclic polyolefin, polyethylene terephthalate, polybutylene terephthalate, polyethylene naphthalate, polybutylene naphthalate, polyvinyl chloride, polymethylmethacrylate, polyvinyl acetate, polystyrene, polymethylpentene, polyimide, polyphenylene sulfide, polysulfone, polyethersulfone, polyetherketone, polyamide-imide, polyetherimide, polyacetal, polycarbonate, polyphenylene ether, polyacrylonitrile, cellophane, and paper, to which, excluding the fluorine resin, a fluorine-based peeling agent or a silicone/fluorine-based peeling agent is applied.

18. A production method for the bio-electrode according to any one of claims 1 to 17, the method comprising:

preparing a conducting path that penetrates a porous, stretchy base material, or preparing a conducting path on the stretchy base material so that the conducting path is exposed on a side surface of the stretchy base material and forming an adhesive, conductive film comprising silicon so as to be connected to one side of the conducting path, the one side being attached to a skin.

19. The production method for the bio-electrode according to claim 18, the method comprising:

forming the adhesive, conductive film containing silicon on one side of the conducting path that

penetrates the porous, stretchy base material, or the conducting path that is on the stretchy base material and exposed on a side surface of the stretchy base material, the one side being attached to a skin,

by transferring the formed, adhesive, conductive film comprising silicon onto a release linear or by directly printing the formed, adhesive, conductive film comprising silicon onto the conducting path.

20. The production method for the bio-electrode according to claim 18 or 19, further comprising applying an adhesive, conductive film material comprising silicon onto a release linear and curing the adhesive, conductive film material.

21. A measurement method for a bio-signal comprising:

attaching the bio-electrode according to any one of claims 1 to 17 to a skin; and

measuring the bio-signal after showering, or during bathing or showering.