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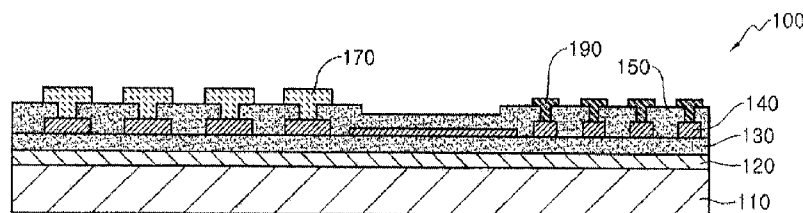
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(54) Title: MANUFACTURING METHOD OF MICROELECTRODE ARRAY AND CONNECTOR CONNECTION METHOD USING THE SAME

[Fig. 2h]



(57) Abstract: Disclosed herein are a manufacturing method of a microelectrode array and a connector connection method using the same. In one embodiment, a manufacturing method of a microelectrode array includes: depositing a sacrificial layer on a silicon substrate; patterning a first polymer on the deposited sacrificial layer and then thermally curing the first polymer; patterning a metal thin film on the first polymer to form a bonding pad site, an interconnectionline and a recording pad site; closing the interconnection line site and coating a second polymer to pattern the bonding pad site and the recording pad site; and performing electroplating on the bonding pad site, thereby forming bonding pads that come in contact with the metal thin film.



Description

Title of Invention: MANUFACTURING METHOD OF MICRO-ELECTRODE ARRAY AND CONNECTOR CONNECTION METHOD USING THE SAME

Technical Field

- [1] Disclosed herein are a manufacturing method of a microelectrode array and a connector connection method using the same. More particularly, disclosed herein are a manufacturing method of a microelectrode array and a connector connection method using the same, in which a bonding portion of the flexible microelectrode array is formed through electroplating, so that impedance at each interface can be decreased when the microelectrode array is connected to the connector.

Background Art

- [2] The study on electrophysiological signals from a nervous system requires a very complicated process because of changes in the impedance of microelectrodes. Therefore, an equal nervous system network is necessarily constructed by normalizing all electrodes in a microelectrode array so as to simplify complicated operational characteristics related to electrophysiological signals. Equally low impedance reduces thermal noises and controls stimulation. Also, the equally low impedance minimizes production of artifacts.
- [3] Electrical stimulation is a general technique used to induce cellular reactions in a nervous system. Recently, it has been known that voltage stimulation has a mechanism capable of preventing harmful electrochemical reactions, and is more advantageous than current stimulation. The efficiency of stimulation, generally determined by local depolarization, is related to impedance of electrodes. Therefore, the uniformity of the local polarization can be achieved by normalized impedance. If the impedance is decreased, the magnitude required in the voltage stimulation is decreased, and thus, it is possible to reduce artifacts produced when stimulation is applied.
- [4] Conventionally, when manufacturing a flexible microelectrode array, there was used a method of connecting a bonding portion of electrodes to a connector manufactured with a printed circuit board (PCB) through wiring so as to measure electrophysiology signals generated by voltage stimulation or a method of connecting a bonding portion of electrodes to a surface mounting type (SMT) connector by Pb soldering the connector to the bonding portion.
- [5] Here, the bonding portion of the electrodes is connected to the connector through wiring or Pb soldering, and therefore, contact resistance may be increased based on their contact degree. Since it is difficult to bond the bonding portion of the electrodes

to the connector using an automated machine, the impedance matching between the bonding portion of the electrodes and the connector may not be achieved.

- [6] FIG. 1 is a view illustrating a related art method of connecting a microelectrode array to a connector. Referring to FIG. 1, signals inputted through a recording site 10 are transmitted to electrodes of a microelectrode array 1 through interconnection lines 20. Here, the recording site 10 comes in direct contact with a part to be measured. A zero insertion force (ZIF) connector 30 is connected to a bonding portion of the electrodes so as not to do damage to the bonding portion of the electrodes, and an SMT microsocket 40 is connected to the ZIF connector 30. However, in the method, contact resistance is unstable, and heat damage may occur at a connection portion 50 between the ZIF connector 30 and the SMT microsocket 40. Therefore, it is difficult to achieve normalized impedance.

Disclosure of Invention

Technical Problem

- [7] Disclosed herein are a manufacturing method of a microelectrode array and a connector connection method using the same, which can reduce impedance mismatching caused at all interfaces from recording pads to a circuit for amplifying and filtering signals and achieve low impedance.

Solution to Problem

- [8] In an aspect, there is provided a manufacturing method of a microelectrode array, which includes: depositing a sacrificial layer on a silicon substrate; patterning a first polymer on the deposited sacrificial layer and then thermally curing the first polymer; patterning a metal thin film on the first polymer to form a bonding pad site, an interconnection line and a recording pad site; closing the interconnection line site and coating a second polymer to pattern the bonding pad site and the recording pad site; and performing electroplating on the bonding pad site, thereby forming bonding pads that come in contact with the metal thin film.
- [9] The sacrificial layer may be formed of aluminum (Al).
- [10] The manufacturing method may further include patterning a photoresist on the second polymer, and removing the photoresist after the bonding pads are formed through the electroplating.
- [11] In the electroplating, the surface roughness of the bonding pads may be controlled by adjusting current density.
- [12] The metal used in the electroplating may include nickel (Ni), copper (Cu), gold (Au), platinum (Pt), silver (Ag) or nickel cobalt (NiCo).
- [13] The manufacturing method may further include depositing a metal on the recording pad site, thereby forming the recording pads that come in contact with the metal thin

film.

- [14] The manufacturing method may further include patterning a photoresist on the second polymer before depositing the metal, and removing the photoresist after the recording pads are formed by depositing the metal.
- [15] The deposited metal may include gold (Au), platinum (Pt), silver (Ag), tungsten (W), molybdenum (Mo), copper (Cu), stainless steel (SUS-27), iron (Fe) or silver-silver chloride (Ag-AgCl).
- [16] In an aspect, there is provided a connection method of a microelectrode array and a connector, which includes: forming a microelectrode array and alignment marks on a substrate; aligning the alignment marks and a shadow mask and then coating a bonding material on bonding pads of the microelectrode array through openings of the shadow mask; and aligning pins of the connector on the bonding pads of the microelectrode array and then bonding the pins of the connector to the bonding pads of the microelectrode array, wherein a manufacturing method of the microelectrode array comprises: depositing a sacrificial layer on a silicon substrate; patterning a first polymer on the deposited sacrificial layer and then thermally curing the first polymer; patterning a metal thin film on the first polymer to form a bonding pad site, an interconnection line and a recording pad site; closing the interconnection line site and coating a second polymer to pattern the bonding pad site and the recording pad site; and performing electroplating on the bonding pad site, thereby forming bonding pads that come in contact with the metal thin.
- [17] The connection method may further include peeling off the sacrificial layer after the connector is bonded to the microelectrode array.
- [18] The sacrificial layer may be peeled off using an aluminum (Al) etchant, diluted hydrofluoric acid (HF) or tetramethylammonium hydroxide (TMAH) photoresist (PR) developer.
- [19] The connection method may further include attaching a plate beneath the first polymer after the sacrificial layer is peeled off, wherein the plate is a wafer substrate formed of metal, plastic, silicon, GaAs, glass or quartz.
- [20] The aligning of the pins of the connector on the bonding pads of the microelectrode array may include picking the connector through a vacuum pick-up area of the connector using an automatic mounting machine and placing the connector so that the pins of the connector are positioned on the bonding pads of the microelectrode array.
- [21] The connector may include a receptacle and a header, each of which has a plurality of pins. The header may be metal-fitted at a central portion of the receptacle. The pins of the header may be directly connected to the bonding pads of the microelectrode array. The receptacle may be connected to a signal processing circuit through wires.
- [22] The bonding material may include an alloy selected from the group consisting of Au-

Ge, Au-In, Au-Sn, Ag-Sn and Pb-Sn.

[23] The bonding material may include an alloy selected from the group consisting of Au-Ge, Au-In, Au-Sn, Ag-Sn and Pb-Sn.

[24] The connection method may further include depositing platinum on the recording pad site, thereby forming recording pads that come in contact with the metal thin film.

[25] The connection method may further include performing finish-processing on the pins of the connector using epoxy made of an insulating material.

Advantageous Effects of Invention

[26] In the manufacturing method of the microelectrode array and the connector connection method using the same, disclosed herein, a bonding portion of electrodes is directly connected to a connector, so that artifacts produced through soldering can be reduced, and interface having normalized impedance can be formed.

[27] In the manufacturing method of the microelectrode array and the connector connection method using the same, disclosed herein, a metal of the bonding portion of the electrodes directly connected to the connector is formed through electroplating. Accordingly, impedance can be lowered by increasing mechanical strength and increasing surface roughness when the bonding portion is connected to the connector.

[28] In the manufacturing method of the microelectrode array and the connector connection method using the same, disclosed herein, the bonding portion of the electrodes can be firmly connected to pins of the connector, using a conductive material such as a silver (Ag) paste or lead (Pb) paste, or an alloy such as Au-Ge, Au-In, Au-Sn, Ag-Sn or Pb-Sn.

Brief Description of Drawings

[29] FIG. 1 is a view illustrating a related art method of connecting a microelectrode array to a connector.

[30] FIGS. 2A to 2H are sectional views illustrating a manufacturing method of a microelectrode array according to an embodiment.

[31] FIGS. 3A to 3C are schematic views illustrating a connection method of a microelectrode array and a connector according to an embodiment.

[32] FIGS. 4A and 4B are sectional views illustrating in detail the connection method of a microelectrode array and a connector according to the embodiment.

[33] FIG. 5 is a block diagram schematically illustrating a configuration in which the microelectrode array manufactured according to the embodiment is connected to the connector.

[34] FIG. 6 is a perspective view of the connector illustrated in FIG. 5.

Mode for the Invention

[35] Exemplary embodiments now will be described more fully hereinafter with reference

to the accompanying drawings, in which exemplary embodiments are shown. This disclosure may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth therein. Rather, these exemplary embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of this disclosure to those skilled in the art. In the description, details of well-known features and techniques may be omitted to avoid unnecessarily obscuring the presented embodiments.

- [36] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of this disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. Furthermore, the use of the terms a, an, etc. does not denote a limitation of quantity, but rather denotes the presence of at least one of the referenced item. The use of the terms "first", "second", and the like does not imply any particular order, but they are included to identify individual elements. Moreover, the use of the terms first, second, etc. does not denote any order or importance, but rather the terms first, second, etc. are used to distinguish one element from another. It will be further understood that the terms "comprises" and/or "comprising", or "includes" and/or "including" when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.
- [37] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.
- [38] In the drawings, like reference numerals in the drawings denote like elements. The shape, size and regions, and the like, of the drawing may be exaggerated for clarity.
- [39] FIGS. 2A to 2H are sectional views illustrating a manufacturing method of a micro-electrode array according to an embodiment. A flexible microelectrode array through processes illustrated in FIGS. 2A to 2H, and a bonding portion of electrodes are formed through electroplating.
- [40] Referring to FIG. 2A, a material used as a sacrificial layer 120 is deposited on a prepared silicon substrate 110. In this embodiment, the sacrificial layer 120 is formed of aluminum (Al) and is deposited on the silicon substrate 110 using an apparatus such as an e-beam evaporator or sputter.
- [41] If a process for forming the electrodes is completed and the bonding portion of the

electrodes is then connected to a connector, the deposited sacrificial layer 120 is peeled off from the silicon substrate 110. The sacrificial layer 120 may be peeled off using an aluminum (Al) etchant, diluted hydrofluoric acid (HF) or tetramethylammonium hydroxide (TMAH) photoresist (PR) developer, but is not limited thereto. The method of peeling off the sacrificial layer 120 may be modified based on the kind of a bonding material used when the bonding portion of the electrodes is connected to the connector.

[42] Referring to FIG. 2B, a first polymer 130 is coated on the sacrificial layer 120. After the shape of the electrodes is patterned, thermal curing is then performed to the first polymer 130. In this embodiment, the first polymer 130 is formed of polyimide or pyridine or SU-8 having compatibility and high strength so as to form a flexible micro-electrode array. In order to reduce the number of processes, photosensitive polyimide or pyridine or SU-8 may be used as the first polymer 130.

[43] Referring to FIG. 2C, metal thin film patterning is performed through a lift-off process so as to form a bonding pad site, an interconnection line and a recording pad site.

[44] Typically, low adhesion rate of metal to the hydrophobic surface drops the metal deposition rate. Therefore, a process for improving the adherence of the surface to the metal is necessary to be performed before the metal deposition, thereby forming a metal thin film 140.

[45] The method for improving the adherence between the polymer and metal layers may include, for example, a surface reforming method using O₂ plasma, a physical roughing method using argon (Ar), or the like. The deposited metal may include gold (Au), platinum (Pt) or the like, which is chemically stable. Titanium (Ti), chrome (Cr) or the like may be used as an adhesion metal.

[46] Referring to FIG. 2D, a second polymer 150 is coated to insulate the interconnection line and patterned with open bonding and recording pad sites. In this embodiment, the second polymer 150 may be polyimide or pyridine or SU-8 like the first polymer 130.

[47] Referring to FIGS. 2E and 2F, bonding pads 170 are formed through electroplating so as to directly connect the bonding portion of the electrodes to the connector. Here, the bonding portion is a site including a part at which the bonding pads 170 exist, and the bonding pads 170 refer to metal portions connected directly to pins of the connector.

[48] Specifically, in order to form the bonding pads 170, a seed layer (not shown) is deposited using an e-beam evaporator or sputter, and patterning is performed on the deposited seed layer using a photoresist 160. Subsequently, if the bonding pads 170 are formed through the electroplating, the photoresist 160 and the seed layer are sequentially removed.

[49] In this embodiment, the roughness of surfaces of the electrodes can be increased by

adjusting current density in the electroplating. Accordingly, the surface of each of the electrodes may have a wider surface area, and its impedance may be lowered. In the electroplating, the bonding pads 170 may be formed using nickel (Ni), copper (Cu), gold (Au), platinum (Pt), silver (Ag) or nickel-cobalt (NiCo).

[50] Referring to FIGS. 2G and 2H, recording pads 190 are formed by depositing a metal using an evaporator or sputter. The deposited metal may include gold (Au), platinum (Pt), silver (Ag), tungsten (W), molybdenum (Mo), copper (Cu), stainless steel (SUS-27), iron (Fe) or silver-silver chloride (Ag-AgCl). Here, the platinum has properties of strong chemical erosion, excellent resistance, low threshold potential and biocompatibility. A photoresist 180 is patterned so as to form the recording pad 190. After the recording pad 190 is formed, the photoresist 180 is removed.

[51] Meanwhile, it has been illustrated in FIGS. 2G and 2H that the bonding pads 170 and the recording pads 190 are separately formed. However, according to another embodiment, the bonding pads 170 and the recording pads 190 may be simultaneously formed through electroplating, and the metal used in the electroplating may include nickel (Ni), copper (Cu), gold (Au), platinum (Pt), silver (Ag) or nickel-cobalt (NiCo).

[52] Hereinafter, a method of connecting the microelectrode array formed through the aforementioned processes to the connector will be described.

[53] FIGS. 3A to 3C are schematic views illustrating a connection method of a microelectrode array and a connector according to an embodiment.

[54] The microelectrode array 100 formed through the processes of FIGS. 2A to 2H is not immediately peeled off from the silicon substrate 110. Referring to FIG. 3A, alignment marks 210 are simultaneously formed during the metal thin film patterning of FIG. 2C so as to connect the microelectrode array 100 to the connector. The alignment marks 210 may be formed of gold (Au) or platinum (Pt) like the bonding pad, the inter-connection line and the recording pad. Alternatively, the alignment marks 210 may be formed during the processes of FIGS. 2F and 2H.

[55] Subsequently, a silver paste (Ag paste) that is a bonding material is coated on the bonding portion of the electrodes so that the bonding pads 170 are directly connected to the connector. To this end, a shadow mask 300 is aligned with the alignment marks 210 of the microelectrode array 100, manufactured on the silicon substrate 110, using a naked eye, microscope, aligner or the like. Here, openings 310 shown in FIG. 3B are formed in the shadow mask 300. Then, the silver paste is coated on the bonding portion through a manual or mechanical operation, and the shadow mask 300 is removed.

[56] Subsequently, the bonding pads 170 of the electrodes are directly connected to the connector, and the bonding operation is completed by performing curing at about 100°C for about 1 hour using an oven or the like.

- [57] If the bonding pads 170 are connected to the connector, the sacrificial layer 120 on the silicon substrate 110 is peeled off, so that the microelectrode array 100 attached to the silicon substrate 110 is peeled off from the silicon substrate 110 as illustrated in FIG. 3C.
- [58] After the sacrificial layer 120 is peeled off, a plate may be attached beneath the first polymer 130 so as to reinforce the mechanical strength of the microelectrode array 100. Here, the plate may be a wafer substrate formed of metal, plastic, silicon, GaAs, glass or quartz.
- [59] FIGS. 4A and 4B are sectional views illustrating in detail the connection method of a microelectrode array 100 and a connector 400 according to the embodiment.
- [60] Referring to FIG. 4A, in this embodiment, a bonding material may include a conductive material such as a silver (Ag) paste or lead (Pb) paste, or an alloy such as Au-Ge, Au-In, Au-Sn, Ag-Sn or Pb-Sn. The bonding material forms a solder bump 172 on the bonding portion of the electrodes through the shadow mask 300 in the process of forming the microelectrode array.
- [61] Specifically, after depositing the alloy such as Au-Ge, Au-In, Au-Sn, Ag-Sn or Pb-Sn using an e-beam evaporator or after co-depositing metals such as Au and Sn, Ag and Sn, Au and Ge, Au and In, or Pb and Sn, the solder bump 172 is left only on the bonding portion of the electrodes through a lift-off process.
- [62] In the connection method disclosed herein, the connector 400 may be automatically mounted. Therefore, the connector 400 is aligned on the bonding pads 170 of the electrodes using a manual or mechanical method and then cured at a temperature of 150 to 400°C, so that the bonding pads 170 of the electrodes can be respectively connected to pins 410 of the connector 400. Here, it has been illustrated in FIG. 4 that the number of pins 410 of the connector 400 is four. However, the number of pins 410 is not particularly limited thereto. Practically, the connector may be formed with a few tens of pins.
- [63] After the bonding pads 170 of the microelectrode array 100 are respectively connected to the pins 410 of the connector 400, the pins 410 of the connector 400 may be finish-processed using epoxy made of an insulating material so as to eliminate interference therebetween.
- [64] FIG. 5 is a block diagram schematically illustrating a configuration in which the microelectrode array manufactured according to the embodiment is connected to the connector. FIG. 6 is a perspective view of the connector illustrated in FIG. 5.
- [65] Referring to FIGS. 5 and 6, the connector 400 connected to the bonding portion of the electrodes includes a receptacle 420 and a header 440, each of which has a few tens of surface mounting type (SMT) pins. The header 440 is metal-fitted at a central portion of the receptacle 420, and pins 442 of the header 440 are directly connected to

the bonding portion of the electrodes.

- [66] The receptacle 420 is connected to an amplifier or data acquisition system through wires or the like. Here, the number of connection pins 422 of the receptacle 420 may be controlled based on the number of interconnection lines for processing signals. That is, the number of bonding pads 170 of the electrodes and the number of interconnection lines connected to the header 440 are identical to that of lines of the recording pad.
- [67] Here, the bonding pads 170 of the electrodes are directly connected to several pins 442 of the header 440, respectively. The bonding pads 170 are formed through electroplating so as to increase mechanical strength by forming the metal of the bonding portion of the electrodes in a sufficient thickness and to decrease impedance by increasing the surface roughness.
- [68] In this embodiment, the connector 400 is a connector generally used to perform board-to-board connection. The connector 400 has a small size, a thin thickness and high contact reliability.
- [69] The connector 400 disclosed herein is connected to the microelectrode array through the metal fitting using pins. Thus, when the connector is attached to an experimental animal such as a mouse or rabbit used to extract electrophysiological signals, it is possible to prevent the production of artifacts due to the movement of the experimental animal.
- [70] Since the connector 400 disclosed herein has a sufficient elastic property, it has high contact reliability. The connector 400 disclosed herein is manufactured in a compact size, and an automatic mounting machine may pick and place the connector 400 in vacuum through a vacuum pick-up area 430 of the connector 400. Accordingly, the bonding portion of the electrodes can be automatically connected to the connector 400.
- [71] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

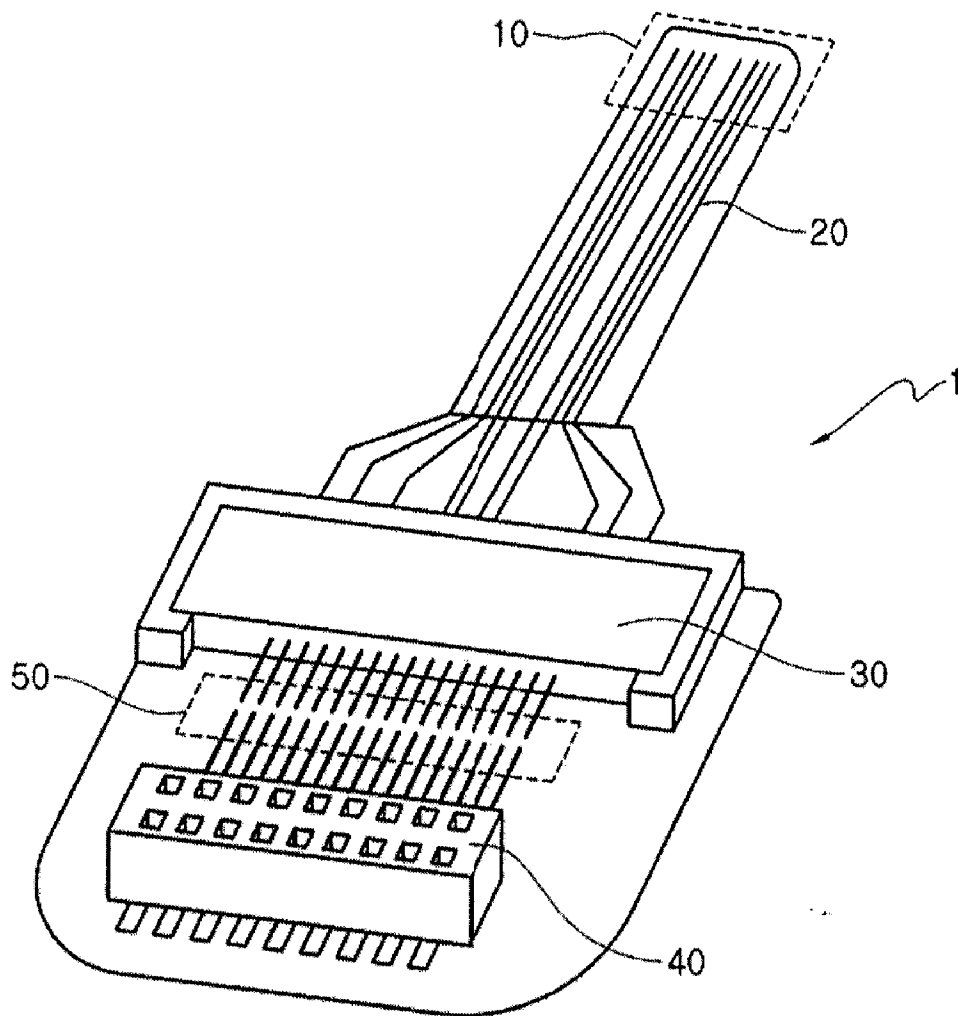
Claims

- [Claim 1] A manufacturing method of a microelectrode array, comprising:
depositing a sacrificial layer on a silicon substrate;
patterning a first polymer on the deposited sacrificial layer and then thermally curing the first polymer;
patterning a metal thin film on the first polymer to form a bonding pad site, an interconnection line and a recording pad site;
closing the interconnectionline site and coating a second polymer to pattern the bonding pad site and the recording pad site; and
performing electroplating on the bonding pad site, thereby forming bonding pads that come in contact with the metal thin film.
- [Claim 2] The manufacturing method according to claim 1, wherein the sacrificial layer is formed of aluminum (Al).
- [Claim 3] The manufacturing method according to claim 1, further comprising patterning a photoresist on the second polymer, and removing the photoresist after the bonding pads are formed through the electroplating.
- [Claim 4] The manufacturing method according to claim 1, wherein, in the electroplating, the surface roughness of the bonding pads is controlled by adjusting current density.
- [Claim 5] The manufacturing method according to claim 1, wherein, when performing the electroplating with respect to the bonding pad site, the electroplating is simultaneously performed with respect to the recording pad site, thereby forming recording pads.
- [Claim 6] The manufacturing method according to claim 5, wherein a metal used in the electroplating includes nickel (Ni), copper (Cu), gold (Au), platinum (Pt), silver (Ag) or nickel-cobalt (NiCo).
- [Claim 7] The manufacturing method according to claim 1, further comprising depositing a metal on the recording pad site, thereby forming the recording pads that come in contact with the metal thin film.
- [Claim 8] The manufacturing method according to claim 7, further comprising patterning a photoresist on the second polymerbefore depositing the metal, and removing the photoresist after the recording pads are formed by depositing the metal.
- [Claim 9] The manufacturing method according to claim 7, wherein the deposited metal includes gold (Au), platinum (Pt), silver (Ag), tungsten (W), molybdenum (Mo), copper (Cu), stainless steel (SUS-27), iron (Fe) or silver-silver chloride (Ag-AgCl).

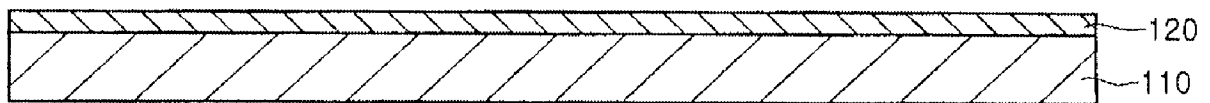
- [Claim 10] A connection method between a microelectrode array applied to brain or nerve or muscle or skull and a connector connected to a data acquisition system, the connection method comprising:
forming a microelectrode array and alignment marks on a substrate;
aligning the alignment marks and a shadow mask and then coating a bonding material on bonding pads of the microelectrode array through openings of the shadow mask; and
aligning pins of the connector on the bonding pads of the microelectrode array and then bonding the pins of the connector to the bonding pads of the microelectrode array,
wherein a manufacturing method of the microelectrode array comprises:
depositing a sacrificial layer on a silicon substrate;
patterning a first polymer on the deposited sacrificial layer and then thermally curing the first polymer;
patterning a metal thin film on the first polymer to form a bonding pad site, an interconnection line and a recording pad site;
closing the interconnection line site and coating a second polymer to pattern the bonding pad site and the recording pad site; and
performing electroplating on the bonding pad site, thereby forming bonding pads that come in contact with the metal thin.
- [Claim 11] The connection method according to claim 10, further comprising peeling off the sacrificial layer after the connector is bonded to the microelectrode array.
- [Claim 12] The connection method according to claim 11, wherein the sacrificial layer is peeled off using an aluminum (Al) etchant, diluted hydrofluoric acid (HF) or tetramethylammonium hydroxide (TMAH) photoresist (PR) developer.
- [Claim 13] The connection method according to claim 11, further comprising attaching a plate beneath the first polymer after the sacrificial layer is peeled off, wherein the plate is a wafer substrate formed of metal, plastic, silicon, GaAs, glass or quartz.
- [Claim 14] The connection method according to claim 10, wherein the aligning of the pins of the connector on the bonding pads of the microelectrode array comprises picking the connector through a vacuum pick-up area of the connector using an automatic mounting machine and placing the connector so that the pins of the connector are positioned on the bonding pads of the microelectrode array.

- [Claim 15] The connection method according to claim 10, wherein:
the connector comprises a receptacle and a header, each of which has a plurality of pins;
the header is metal-fitted at a central portion of the receptacle;
the pins of the header are directly connected to the bonding pads of the microelectrode array; and
the receptacle is connected to a signal processing circuit through wires.
- [Claim 16] The connection method according to claim 10, wherein the bonding material includes a silver (Ag) paste or lead (Pb) paste.
- [Claim 17] The connection method according to claim 10, wherein the bonding material includes an alloy selected from the group consisting of Au-Ge, Au-In, Au-Sn, Ag-Sn and Pb-Sn.
- [Claim 18] The connection method according to claim 10, further comprising depositing platinum on the recording pad site, thereby forming recording pads that come in contact with the metal thin film.
- [Claim 19] The connection method according to claim 10, further comprising performing finish-processing on the pins of the connector using epoxy made of an insulating material.

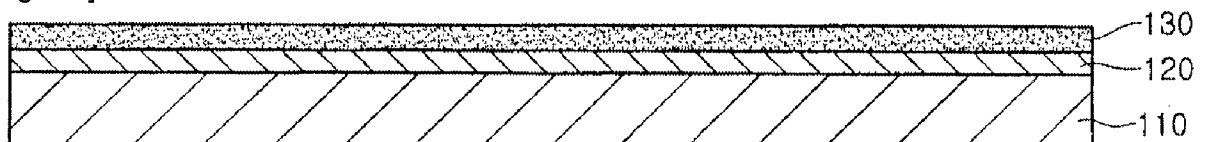
[Fig. 1]



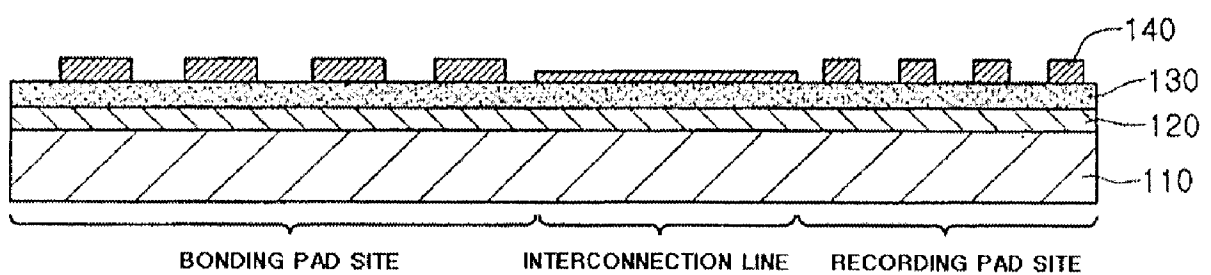
[Fig. 2a]



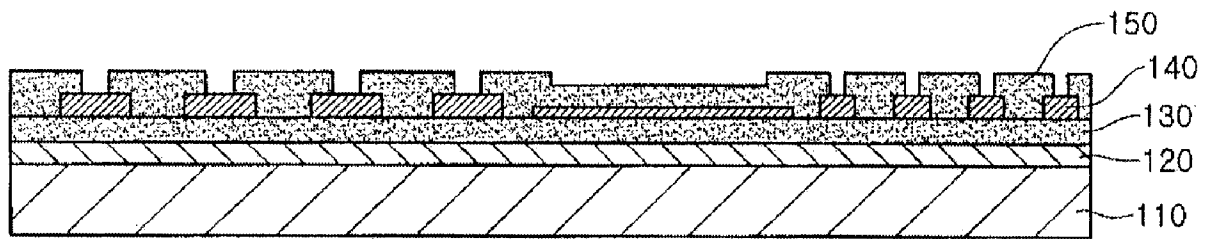
[Fig. 2b]



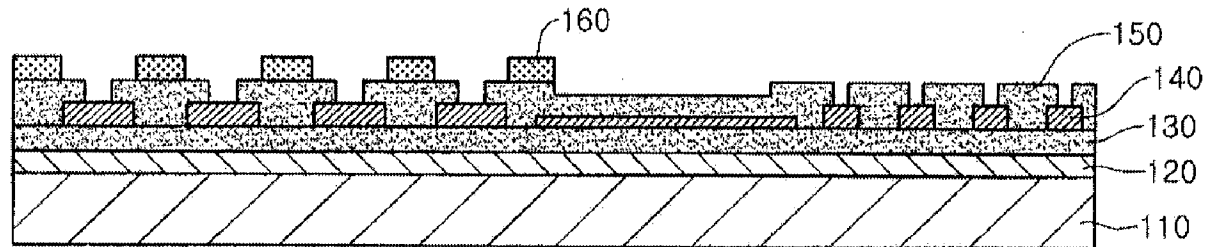
[Fig. 2c]



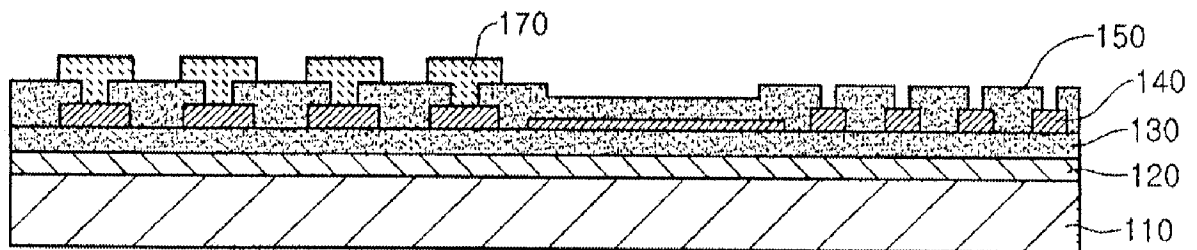
[Fig. 2d]



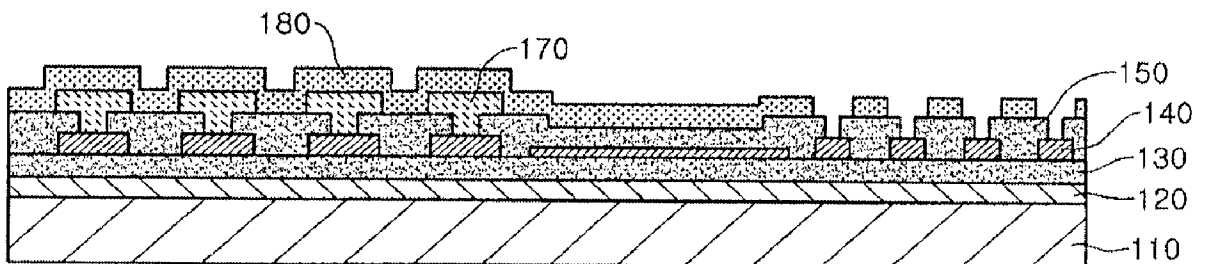
[Fig. 2e]



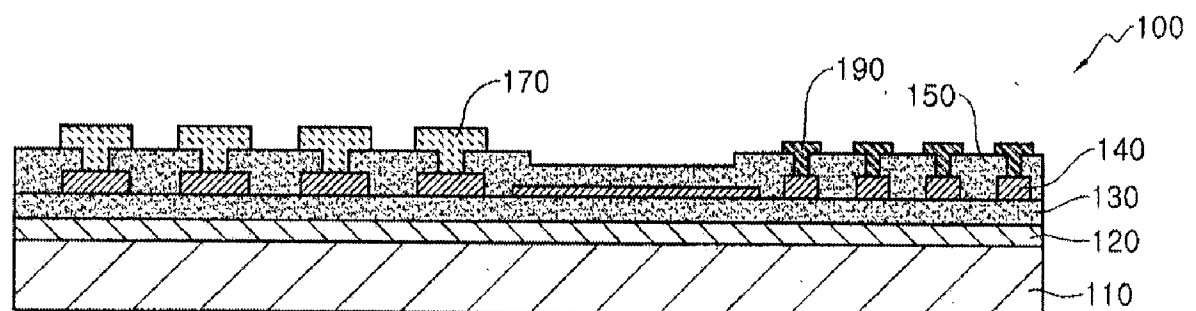
[Fig. 2f]



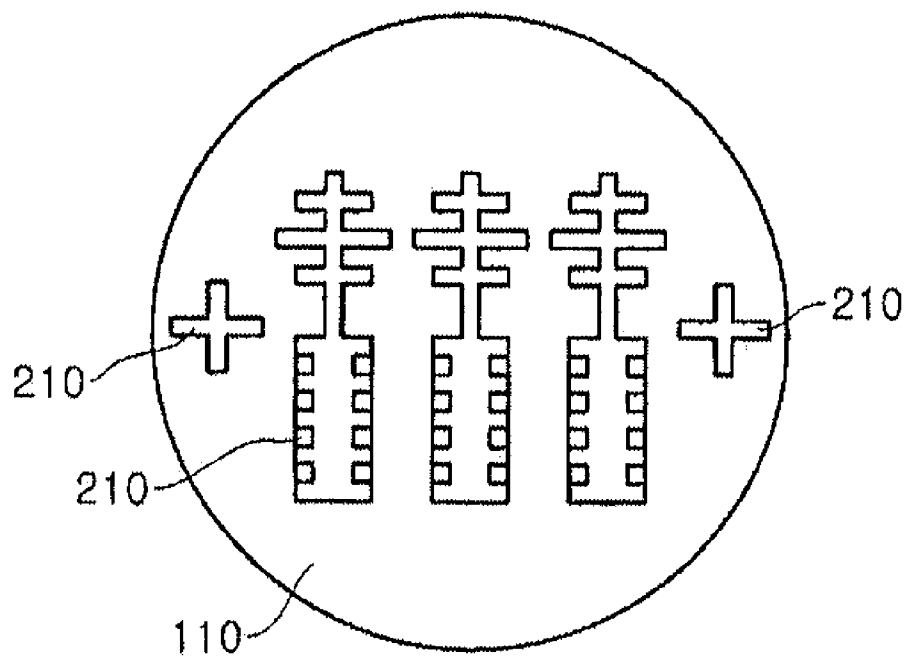
[Fig. 2g]



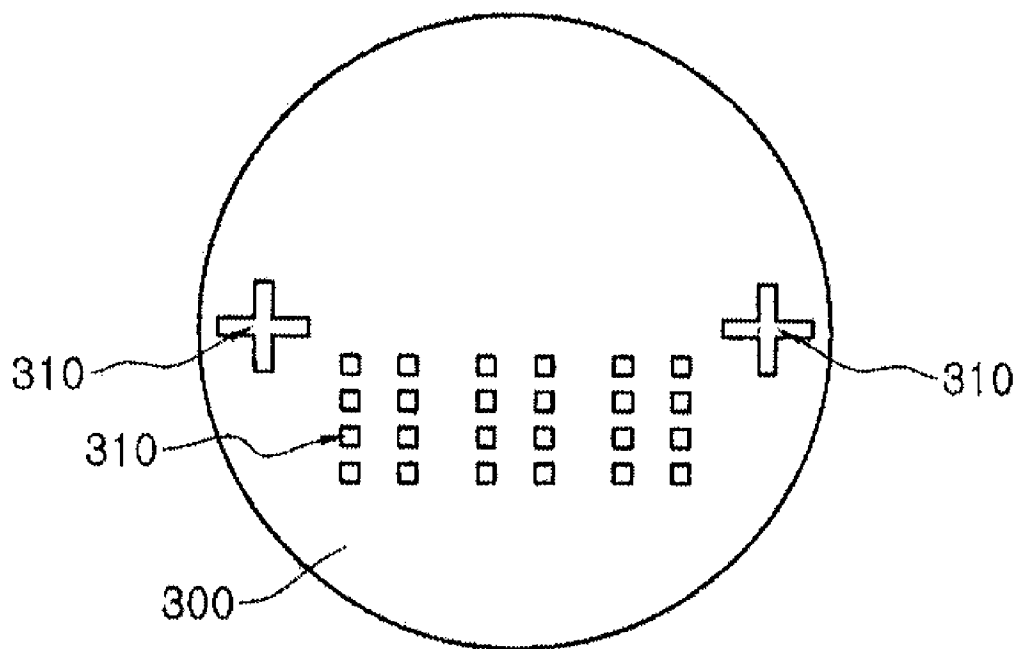
[Fig. 2h]



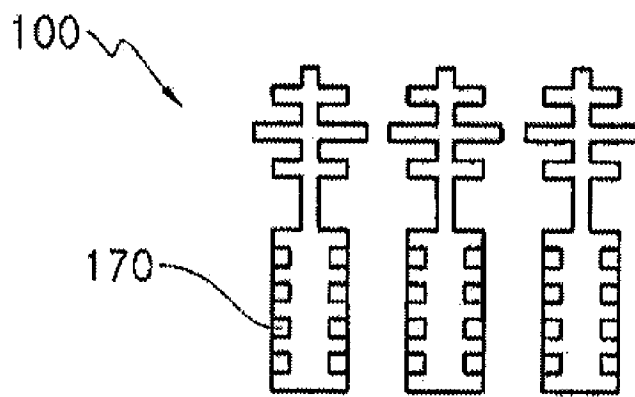
[Fig. 3a]



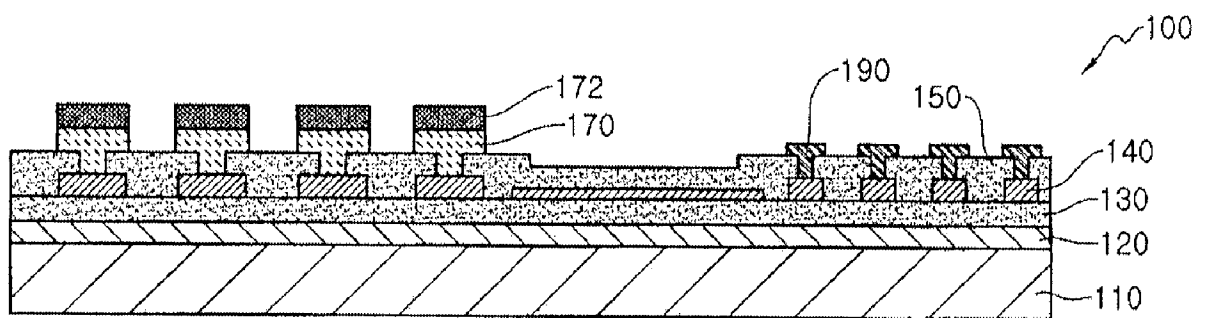
[Fig. 3b]



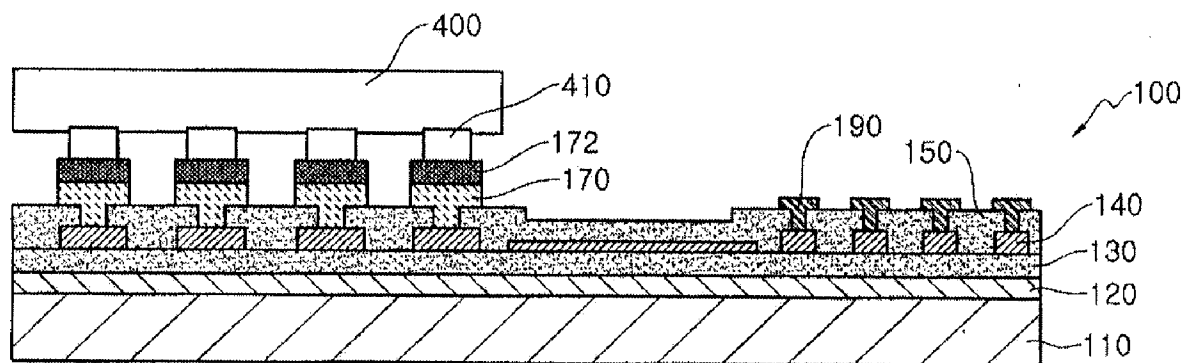
[Fig. 3c]



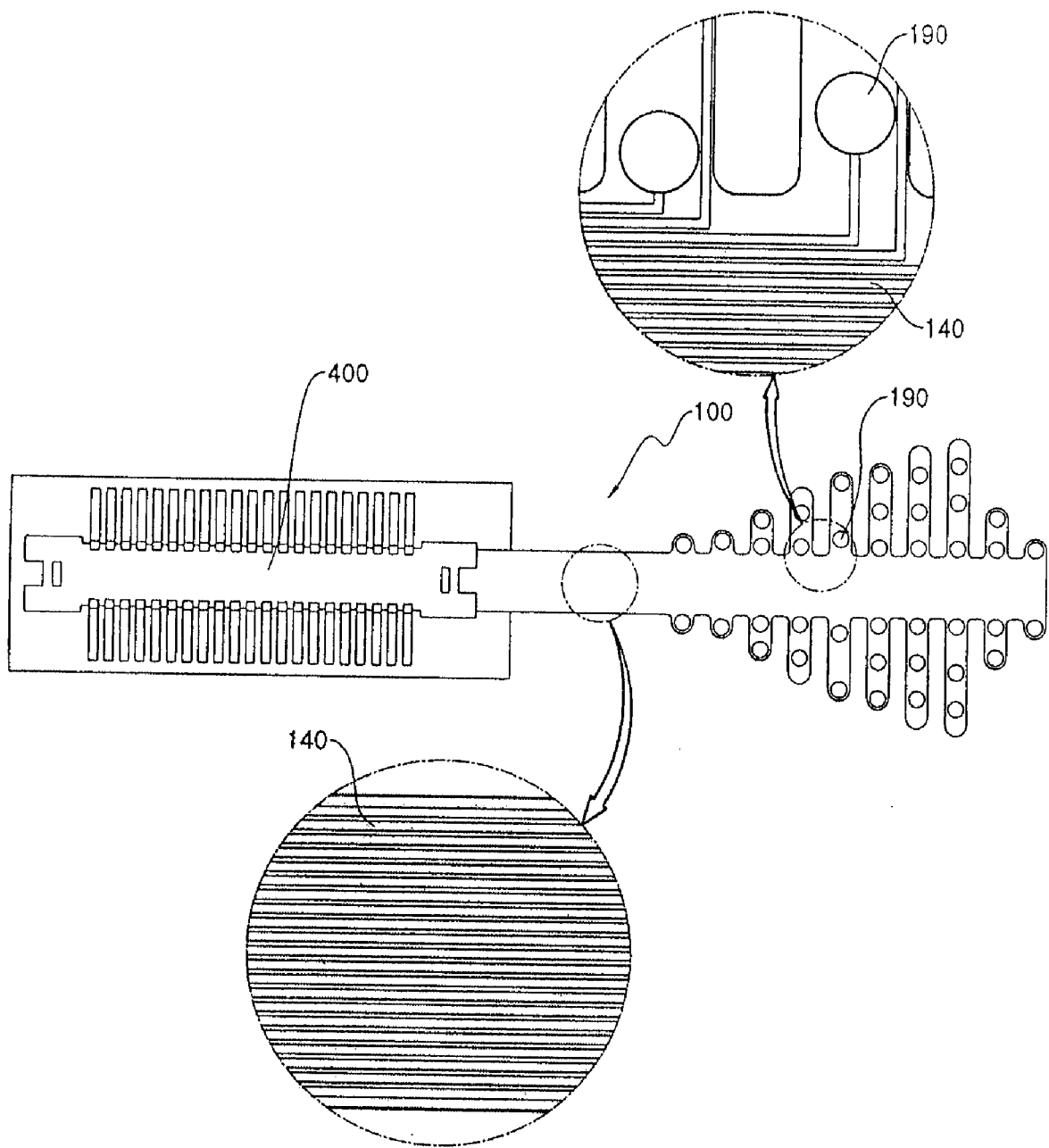
[Fig. 4a]



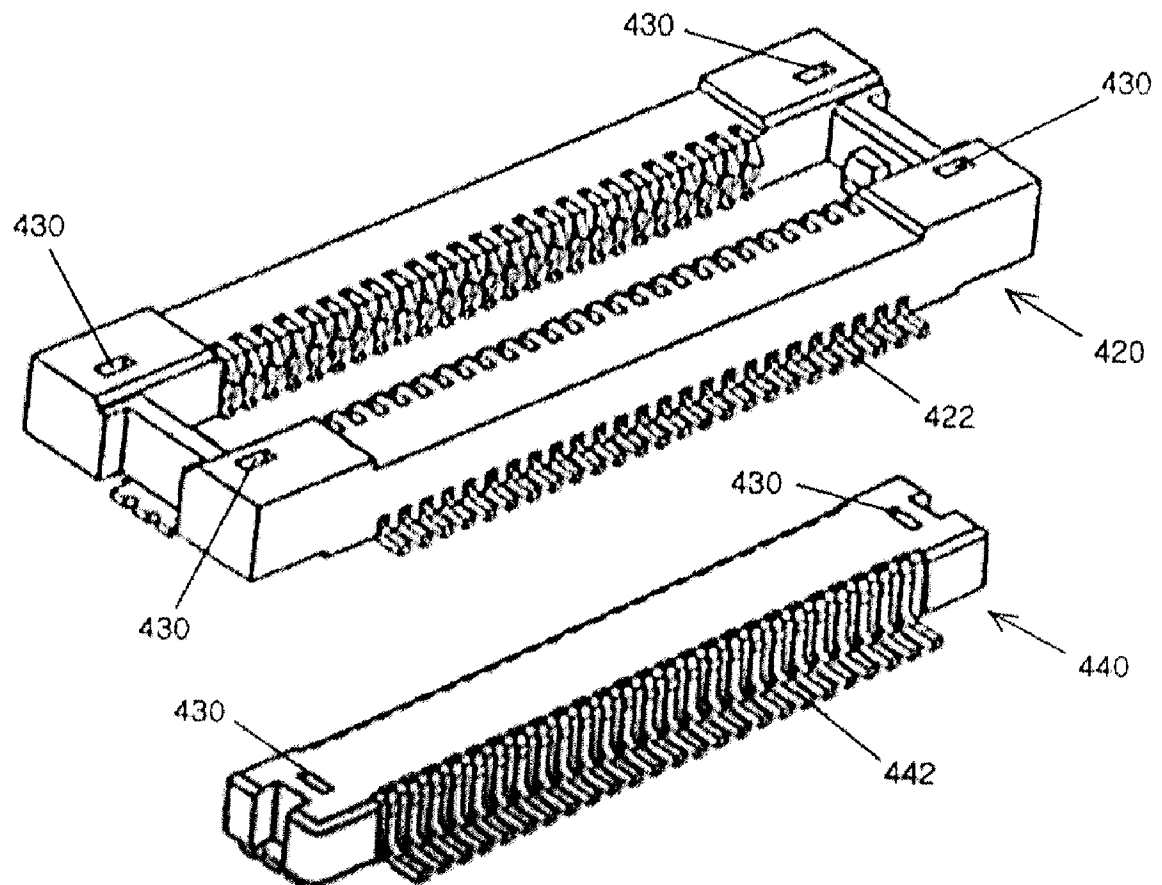
[Fig. 4b]



[Fig. 5]



[Fig. 6]



A. CLASSIFICATION OF SUBJECT MATTER***H01R 43/00(2006.01)i, H01R 13/22(2006.01)i, H01L 29/00(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R 43/00; H01L 21/60; C08G 61/12; H01L 21/52; H01B 5/14; H01L 23/488

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords:electrode,sacrificial,electroplating, seed

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-0705757 B1 (KAIST) 10 April 2007 See abstract; page 3, line 37 - page 4, line 32 and figures 1a-1b.	1-19
A	JP 07-050106 A (OSAKA GAS CO LTD) 21 February 1995 See abstract; page 4, right column, line 26 - page 5, left column, line 14 and figure 2.	1-19
A	JP 2005-064498 A (PHOENIX PRECISION TECHNOLOGY CORP) 10 March 2005 See abstract; paragraph [0043] - paragraph [0049] and figures 3A-3I.	1-19
A	KR 10-0896841 B1 (DONGBU HITEK CO., LTD.) 12 May 2009 See paragraph [0005] - paragraph [0009] and figures 1a-1e.	1-19



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

18 MARCH 2011 (18.03.2011)

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21 MARCH 2011 (21.03.2011)

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KIM, Sung Hee

Telephone No. 82-42-481-5889



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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