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MATSUOKA et al.

(54) **PROBE CARD**

(71) Applicant: **JAPAN ELECTRONIC MATERIALS CORPORATION**, Hyogo (JP)

(72) Inventors: **Keiji MATSUOKA**, Hyogo (JP); **Shingo SATO**, Hyogo (JP); **Tomoaki INOUE**, Hyogo (JP)

(73) Assignee: **JAPAN ELECTRONIC MATERIALS CORPORATION**, Hyogo (JP)

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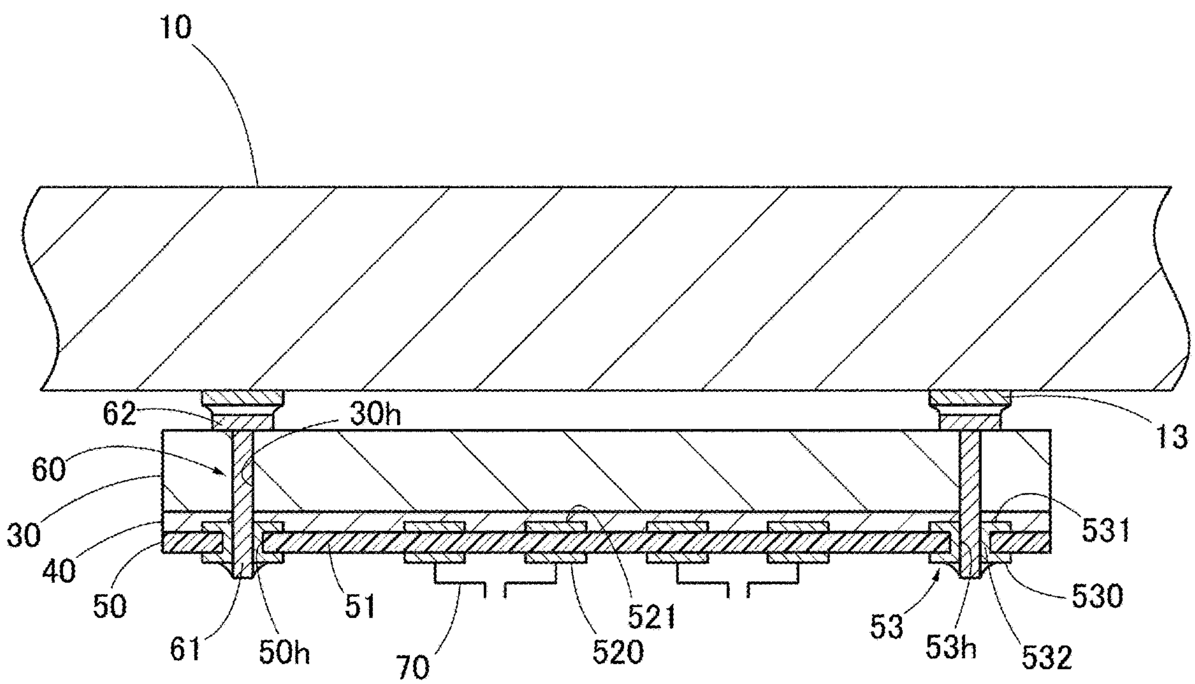
(57) **ABSTRACT**

[Problem] To prevent a flexible wiring board from peeling off from a substrate.
[Solution] This probe card comprises: a substrate **30** having a flat surface that faces an object **20** to be tested; a flexible wiring board **50** which is composed of an insulating film **51** and has an adhesive surface adhered to the substrate **30** via an adhesive agent **40** and a probe mounting surface on which two or more electrode pads **520** are aligned and arranged at a predetermined interval; and two or more probes **70** respectively disposed on the electrode pads **520**. Two or more first anchor pads **521** are respectively formed at positions on the adhesive surface that correspond to the electrode pads **70**.



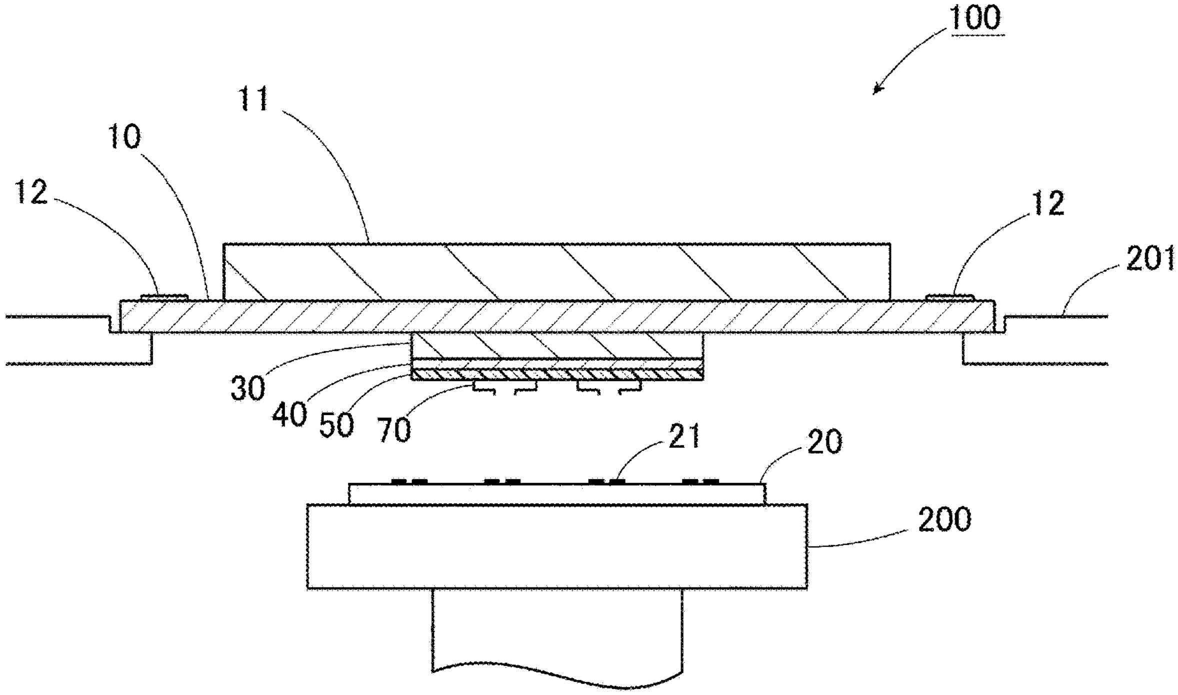


FIG. 1

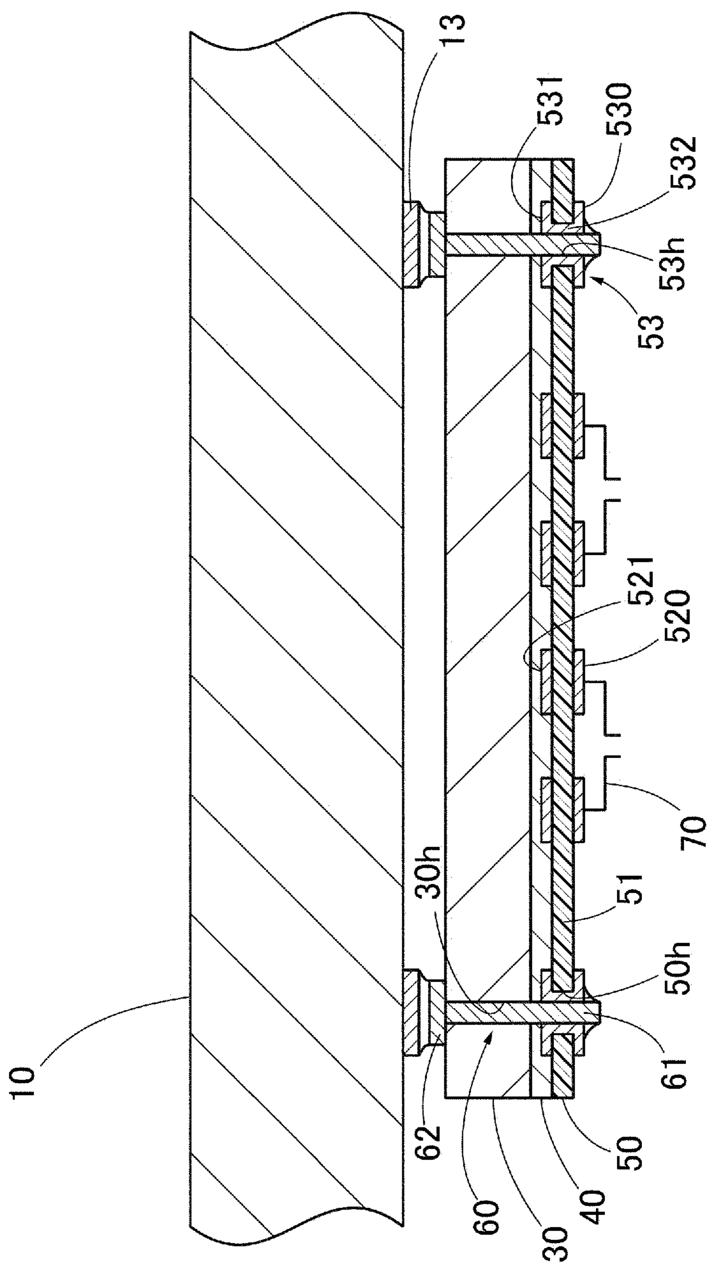


FIG. 2

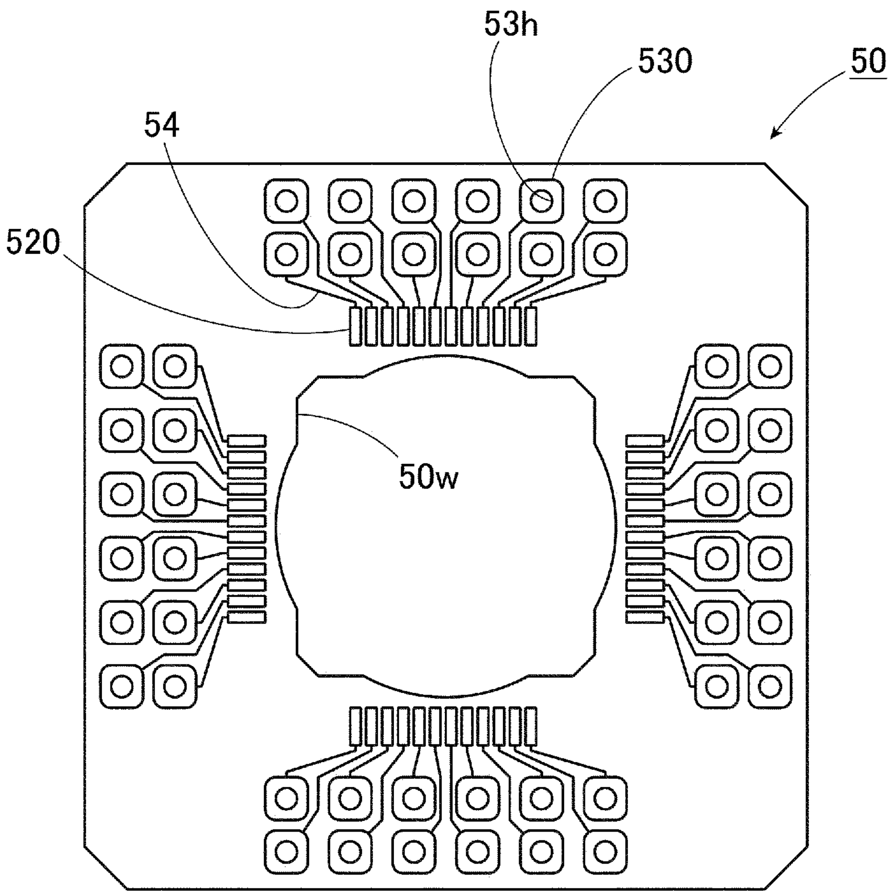


FIG. 3

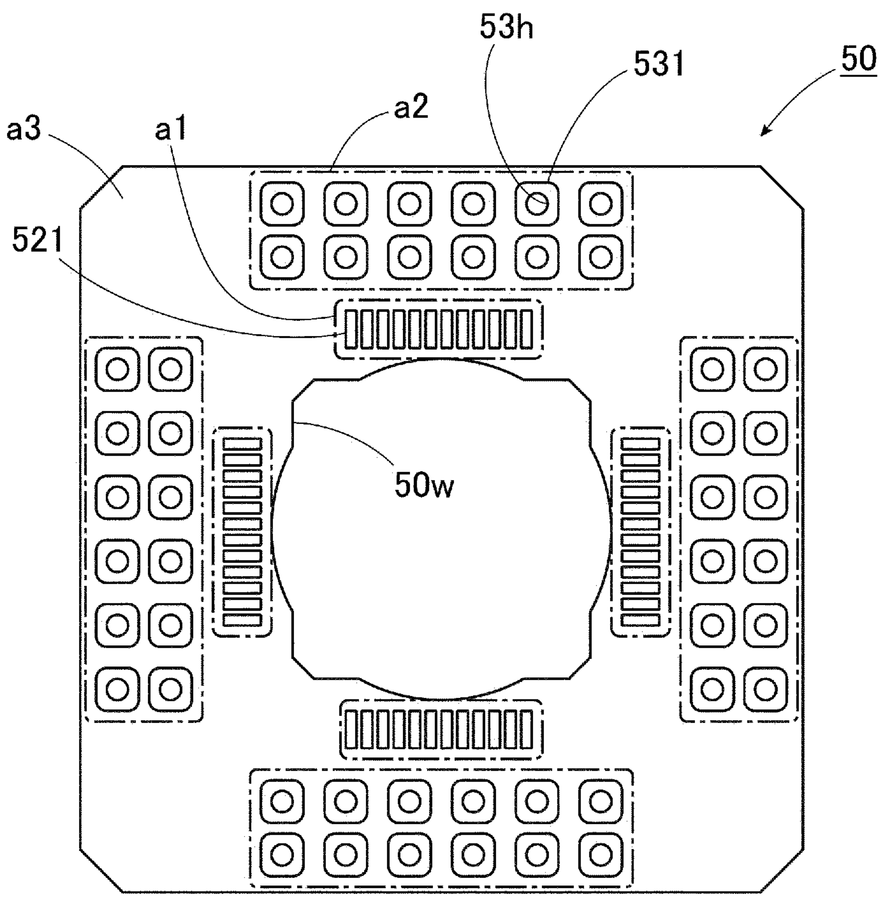


FIG. 4

FIG. 5

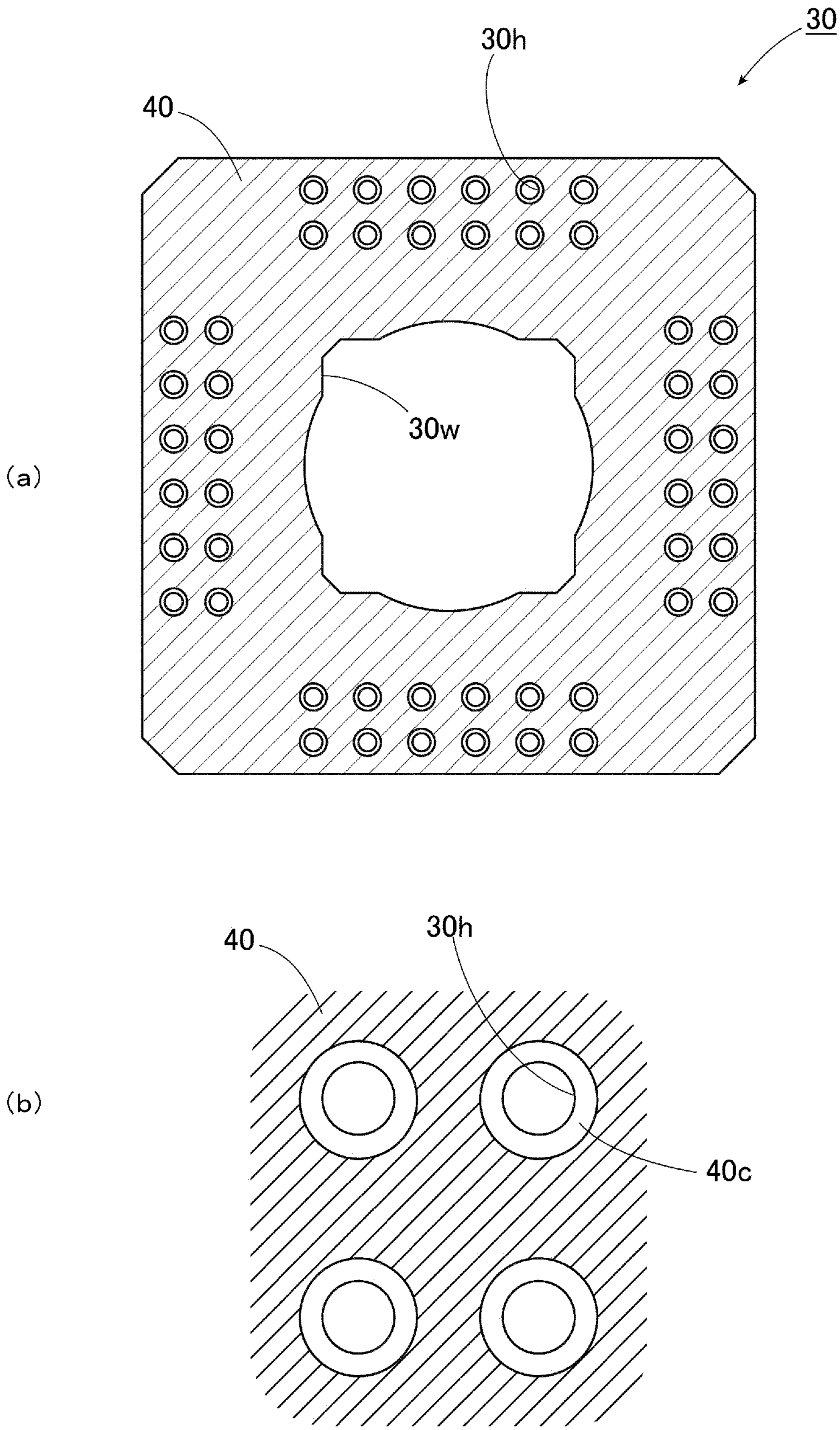
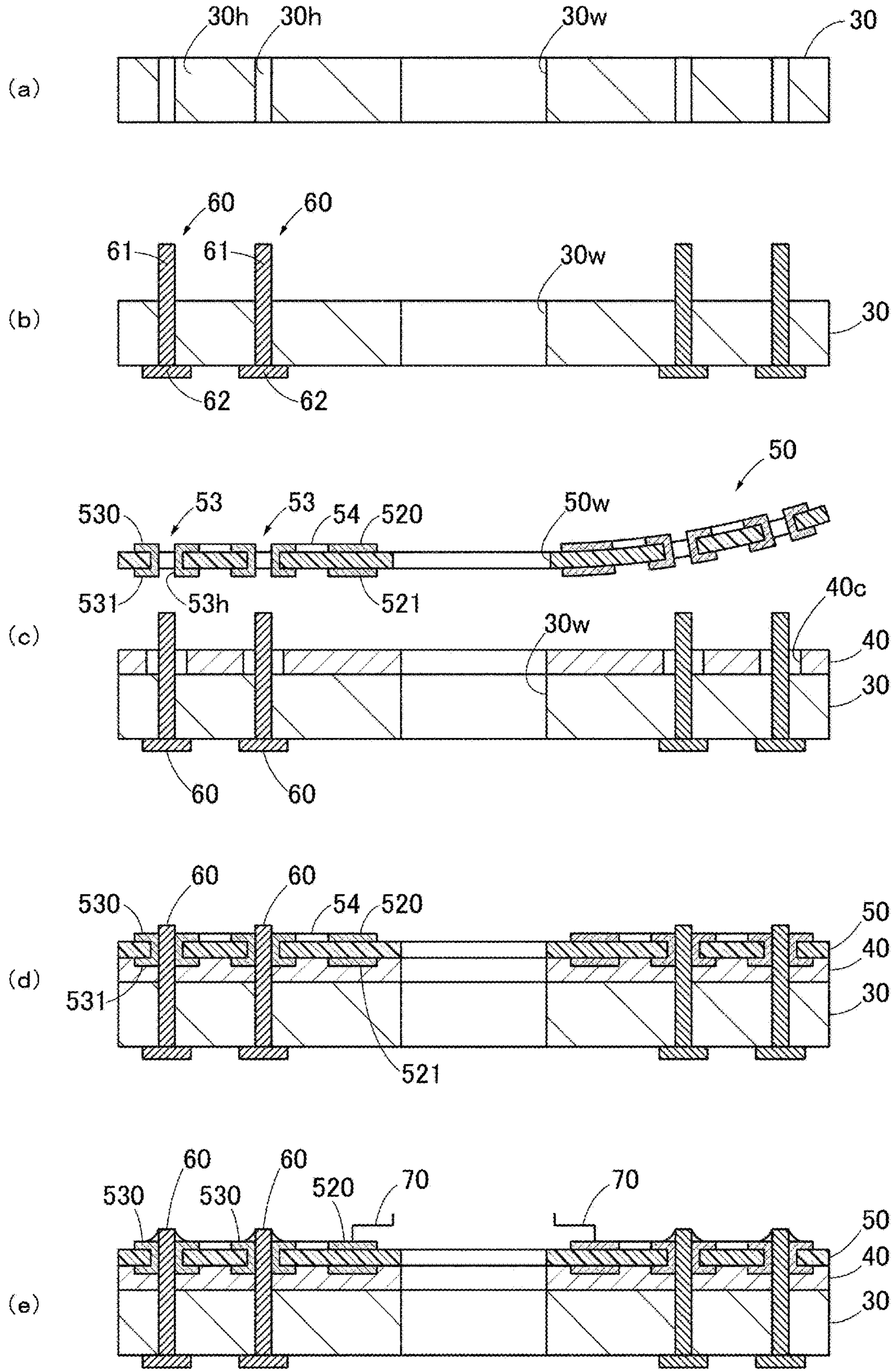


FIG. 6


(a)
30h
30h
30w
30
(b)
60
60
61
61
30w
30
62
62
(c)
50
530
53
53
54
520
50w
531
53h
521
40c
30w
40
30
60
60
(d)
530
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60
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70
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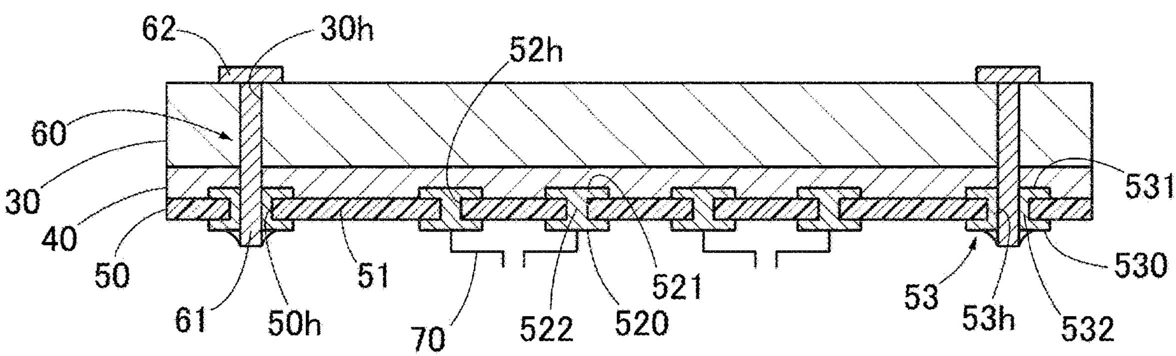

FIG. 7

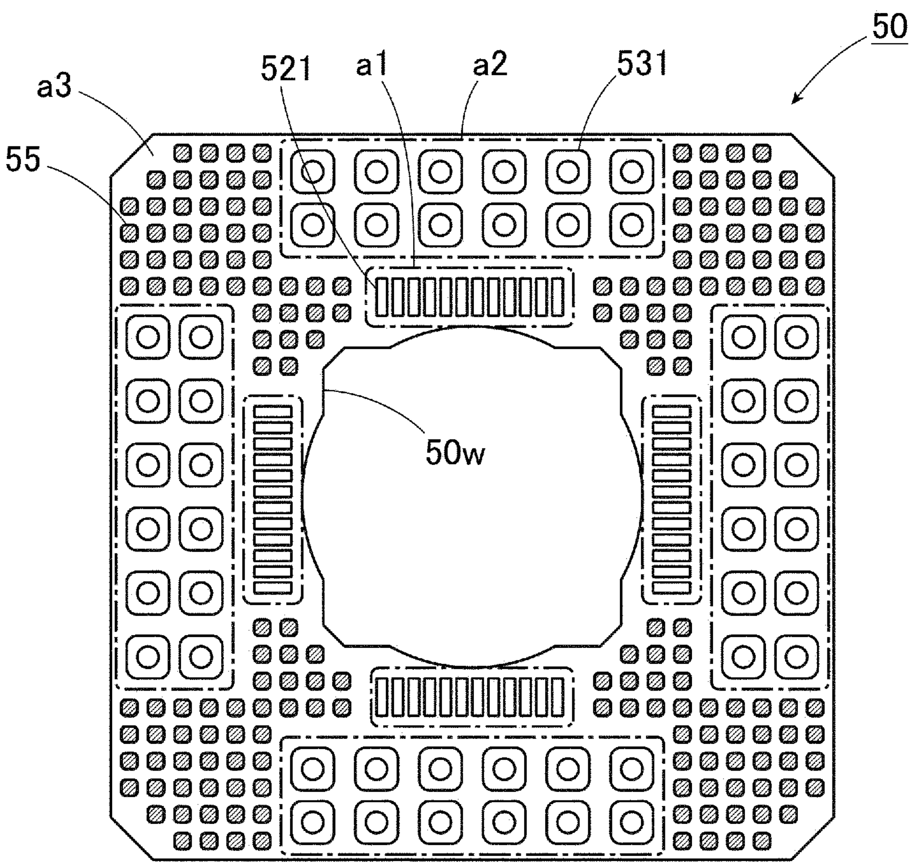

FIG. 8

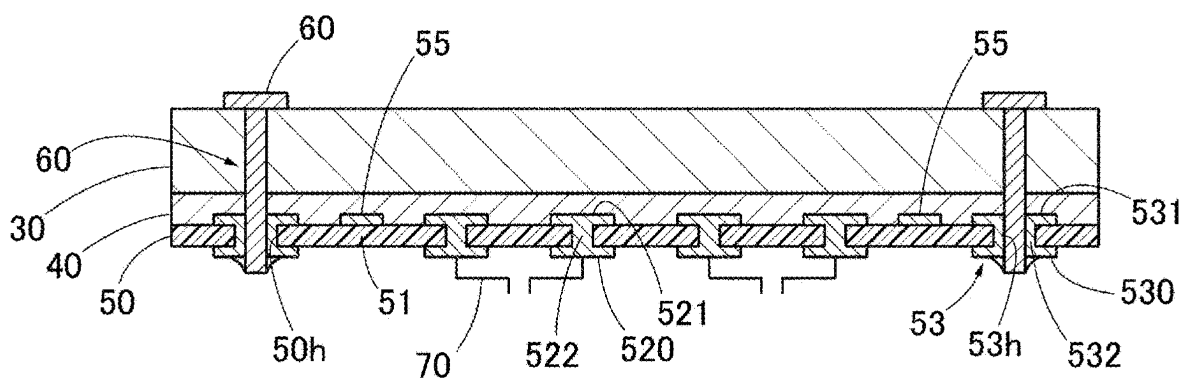

FIG. 9

PROBE CARD

TECHNICAL FIELD

[0001] The present invention relates to a probe card, and more specifically, to an improvement of a probe card equipped with a flexible wiring board.

BACKGROUND OF THE INVENTION

[0002] A probe card is a testing device used for inspecting the electrical characteristics of semiconductor devices formed on a semiconductor wafer. It is equipped with two or more probes on a wiring substrate, with each probe contacting a corresponding electrode formed on the semiconductor wafer. The inspection of the semiconductor device is conducted by bringing the semiconductor wafer close to the probe card, allowing the tips of the probes to contact the electrodes on the wafer, and establishing electrical continuity between the tester device and the semiconductor device through the probes and the wiring substrate.

[0003] A probe card with probes mounted on a flexible wiring board has been conventionally known (for example, Patent Literature 1). In the probe card described in Patent Literature 1, the probes are attached to the central lower surface of the flexible wiring board. This flexible wiring board has its peripheral portion fixed by a ring-shaped retaining plate, and the central upper surface is adhered to the top of a truncated quadrangular pyramid-shaped platform mounted on a leaf spring.

CITATION LIST

Patent Literatures

[0004] [Patent Literature 1] JP 2002-311049 A

SUMMARY OF THE INVENTION

Technical Problem

[0005] In the case of a probe card where probes are mounted on a flexible wiring board, and the flexible wiring board is adhered to the flat surface of a substrate, there is a risk that the flexible wiring board may detach from the substrate if the adhesive strength is insufficient. For example, when the tip of a probe with a cantilever structure is pressed against the object under inspection, a force that tilts the probe is applied to the base of the probe. Consequently, there is a risk that the flexible wiring board may detach from the substrate at the probe mounting location.

[0006] Additionally, variations in the thickness of the adhesive can cause height inconsistencies among the probes, potentially reducing their contact reliability with the object under inspection. Furthermore, when adhering the flexible wiring board, bubbles that form within the adhesive can expand during high-temperature testing and contract during low-temperature testing, leading to a loss of flatness in the flexible wiring board and consequently reducing the contact reliability with the object under inspection.

[0007] The present invention has been made in view of the above circumstances and aims to prevent the flexible wiring board from detaching from the substrate in a probe card where the flexible wiring board is adhered to the substrate. Additionally, it aims to improve the contact reliability between the probe card, with the flexible wiring board adhered to the substrate, and the object under inspection. Specifically, it aims to suppress variations in the height of the probes and to prevent the flatness of the electrode pads, where the probes are positioned, from being compromised.

Solution to the Problem

[0008] A probe card according to the first embodiment of the present invention includes a substrate having a flat surface that faces an object under inspection, a flexible wiring board made of an insulating film and having an adhesive surface adhered to the substrate via an adhesive and a probe mounting surface where two or more electrode pads are aligned and arranged at predetermined intervals, and two or more probes, each disposed on a corresponding one of the two or more electrode pads. Wherein two or more first anchor pads are each formed at positions on the adhesive surface corresponding to the two or more electrode pads.

[0009] By adopting such a configuration, the first anchor pads are aligned and arranged at predetermined intervals. The first anchor pads are protrusions provided on the adhesive surface of the flexible wiring board, and the spaces between adjacent first anchor pads form recesses. As a result, alternating protrusions and recesses are formed on the adhesive surface of the flexible wiring board, increasing the surface area, which allows the flexible wiring board to be more securely adhered to the substrate. Additionally, since the first anchor pads are formed at positions corresponding to the electrode pads, the flexible wiring board is prevented from detaching from the substrate in the area where the electrode pads are formed, even when the probes elastically deform during testing.

[0010] Additionally, excess adhesive on the first anchor pads is accommodated in the recesses, which helps control the thickness of the adhesive layer between the first anchor pads and the substrate. This suppresses variations in the adhesive thickness, reducing height variations among the two or more electrode pads. As a result, height variations among the two or more probes are minimized, improving contact reliability with the object under inspection. Furthermore, by controlling the adhesive thickness, the thermal expansion of bubbles in the adhesive is reduced, preventing the flatness of the electrode pads from being compromised, thereby enhancing contact reliability with the object under inspection.

[0011] A probe card according to the second embodiment of the present invention has, in addition to the above configuration, a configuration in which the substrate is a ceramic substrate. The ceramic substrate has a thermal expansion coefficient similar to that of a silicon wafer, making it resistant to warping and ensuring high flatness. Therefore, by adhering a flexible printed circuit board to the ceramic substrate, the contact reliability with the object under inspection can be improved.

[0012] A probe card according to the third embodiment of the present invention has, in addition to the above configuration, a configuration in which the electrode pads and the first anchor pads are integrally formed through first through-holes in the insulating film, and the first through-holes are enclosed within outer edges of the electrode pads and the first anchor pads.

[0013] By adopting such a configuration, the first anchor pads and the electrode pads are integrally formed, with the insulating film sandwiched between them. This prevents the flexible wiring board from detaching from the substrate due to the first anchor pads separating from the insulating film.

[0014] A probe card according to the fourth embodiment of the present invention has, in addition to the above configuration, a configuration in which the first anchor pads have a shape corresponding to the electrode pads.

[0015] By adopting such a configuration, the thickness of the adhesive in the region corresponding to the electrode pads can be controlled. This prevents variations in the height of the electrode pads and also prevents the flatness of the electrode pads from being compromised due to the thermal expansion of bubbles in the adhesive.

[0016] A probe card according to the fifth embodiment of the present invention, in addition to the above configuration, includes two or more connection pins. Wherein two or more through-holes are aligned and arranged at predetermined intervals in the substrate, each for inserting a corresponding one of the two or more connection pins, two or more second through-holes are formed on the flexible wiring board closer to a peripheral side than the electrode pads, each for inserting a corresponding one of the two or more connection pins, and the electrode pads are electrically connected to the connection pins.

[0017] By inserting the connection pins into the through-holes of the substrate and the second through-holes of the flexible wiring board and electrically connecting the connection pins to the probes, the alignment of the flexible wiring board with the substrate is facilitated, and the high-frequency characteristics of the probe wiring can be improved.

[0018] A probe card according to the sixth embodiment of the present invention has, in addition to the above configuration, a configuration in which two or more electrode terminals are formed on the flexible wiring board, each surrounding an opening of the two or more second through-holes on the probe mounting surface, the connection pins are connected to the electrode terminals, the electrode terminals are connected to the electrode pads on the flexible wiring board, and second anchor pads are formed at positions on the adhesive surface corresponding to the electrode terminals.

[0019] By adopting such a configuration, the second anchor pads are aligned and arranged at predetermined intervals. The second anchor pads are protrusions provided on the adhesive surface of the flexible wiring board, and the spaces between adjacent second anchor pads form recesses. As a result, alternating protrusions and recesses are formed on the adhesive surface of the flexible wiring board, increasing the surface area, which allows the flexible wiring board to be more securely adhered to the substrate.

[0020] A probe card according to the seventh embodiment of the present invention has, in addition to the above configuration, a configuration in which the electrode terminals and the second anchor pads are integrally formed through the second through-holes, and the second through-holes are enclosed within outer edges of the electrode terminals and the second anchor pads.

[0021] By adopting such a configuration, the second anchor pads and the electrode terminals are integrally formed, with the insulating film sandwiched between them. This prevents the flexible wiring board from detaching from the substrate due to the second anchor pads separating from the insulating film.

[0022] A probe card according to the eighth embodiment of the present invention has, in addition to the above configuration, a configuration in which two or more third anchor pads, which do not correspond to either the electrode pads or the electrode terminals, are aligned and arranged at predetermined intervals on the adhesive surface of the flexible wiring board.

[0023] By adopting such a configuration, even in regions where neither the electrode pads nor the connection terminals are formed, protrusions and recesses are created on the adhesive surface of the flexible wiring board, allowing it to be securely adhered to the substrate.

Advantages of the Invention

[0024] According to the present invention, in a probe card where the flexible wiring board is adhered to the substrate, it is possible to prevent the flexible wiring board from detaching from the substrate. Additionally, it is possible to improve the contact reliability between the probe card, with the flexible wiring board adhered to the substrate, and the object under inspection. Specifically, it is possible to suppress variations in the height of the probes and to prevent the flatness of the electrode pads, where the probes are positioned, from being compromised.

BRIEF DESCRIPTION OF DRAWINGS

[0025] FIG. **1** is a cross-sectional view showing an example of the schematic configuration of a probe card **100** according to the first embodiment of the present invention.

[0026] FIG. **2** is an enlarged cross-sectional view of the main part of the probe card **100** shown in FIG. **1**.

[0027] FIG. **3** is a view showing an example of the probe mounting surface of the flexible wiring board **50**.

[0028] FIG. **4** is a view showing an example of the adhesive surface of the flexible wiring board **50**.

[0029] FIG. **5** is a view showing the adhesive formation region on the adhesive surface of the ceramic substrate **30**.

[0030] FIG. **6** is a schematic view showing an example of the manufacturing method of the probe card **100** shown in FIG. **1**.

[0031] FIG. **7** is a cross-sectional view showing an example of the main part configuration of a probe card according to the second embodiment of the present invention.

[0032] FIG. **8** is a view showing the adhesive surface of the flexible wiring board **50** according to the third embodiment of the present invention.

[0033] FIG. **9** is an enlarged cross-sectional view of the main part of the probe card **100** shown in FIG. **8**.

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

[0034] FIG. **1** is a view showing an example of the schematic configuration of a probe card **100** according to the first embodiment of the present invention, and it shows a cross-section of the probe card **100** when cut along a vertical plane. The probe card **100** is mounted on a wafer prober with the probe mounting surface facing downward, positioned opposite to a semiconductor wafer **20** placed on the stage **200**. By moving the stage **200** up and down, the probes **70** can be brought into contact with the test electrodes **21** on the semiconductor wafer **20**.

[0035] The probe card **100** includes a main substrate **10**, a reinforcement plate **11**, a ceramic substrate **30**, an adhesive **40**, a flexible wiring board **50**, and two or more probes

[0036] The main substrate **10** is a wiring board that can be detachably mounted on a wafer prober, and for example, a disc-shaped glass epoxy substrate is used. The main substrate **10** is supported at its peripheral lower surface by the card holder **201** of the wafer prober and is arranged in a substantially horizontal orientation.

[0037] A reinforcement plate **11** is attached to the central portion of the upper surface of the main substrate **10** to suppress distortion of the main substrate **10**. Additionally, two or more external terminals **12**, to which the signal terminals of a tester device (not shown) are connected, are provided at the peripheral portion of the upper surface of the main substrate **10**.

[0038] The ceramic substrate **30** is a flat ceramic plate attached to the central lower surface of the main substrate **10**, serving as a base material to support the flexible wiring board **50**. The upper surface of the ceramic substrate **30** is the mounting surface facing the main substrate **10**, while the lower surface is a flat adhesive surface where the flexible wiring board **50** is adhered. Ceramic is a material known for its excellent flatness and strength, making it resistant to warping, and it also has superior insulating properties. Additionally, the difference in thermal expansion between ceramic and a silicon wafer is minimal, reducing the likelihood of misalignment during high-temperature testing. For these reasons, ceramic is well-suited as a material for the base supporting the probes **70**.

[0039] The adhesive **40** forms an adhesive layer between the ceramic substrate **30** and the flexible wiring board **50**, bonding the flexible wiring board **50** to the ceramic substrate **30**. For the adhesive **40**, a thermosetting adhesive, such as an epoxy resin, can be used.

[0040] The flexible wiring board **50** is a sheet-like wiring board attached to the adhesive surface of the ceramic substrate **30**. The upper surface of the flexible wiring board **50** is the adhesive surface that faces the ceramic substrate **30** via the adhesive **40**, while the lower surface is the probe mounting surface where two or more probes **70** are positioned.

[0041] The flexible wiring board **50** is a wiring board with a conductive pattern formed on a flexible insulating film and is thinner than the ceramic substrate **30**. For example, a flexible printed circuit board using a resin film such as polyimide film can be employed, and a multilayer wiring board composed of multiple resin film layers can also be used.

[0042] The resin film, compared to the ceramic substrate **30**, allows for easier formation of electrode and wiring patterns and facilitates the production of multilayer substrates, making it possible to manufacture at a lower cost. However, it has a greater difference in thermal expansion rate compared to a silicon wafer and is inferior in terms of flatness and strength. Therefore, by bonding the flexible wiring board **50** to the ceramic substrate **30**, it is possible to produce the probe card **100** at a lower cost, while also achieving excellent flatness and strength, and reducing the likelihood of misalignment during high-temperature testing.

[0043] The probes **70** are made of an elastically deformable conductive metal, such as NiCo (nickel-cobalt alloy), and have tips for contacting the test electrodes **21** on the semiconductor wafer **20**. They are mounted on the probe mounting surface of the flexible substrate. The shape of the probes **70** is arbitrary, and various types such as cantilever-type with a cantilever structure or vertical-type utilizing buckling deformation can be used.

[0044] The stage **200** is a platform for placing the semiconductor wafer **20** and is capable of moving and rotating within the horizontal plane, as well as moving in the vertical direction. By horizontally moving or rotating the stage **200**, the positions of the tips of the probes **70** can be aligned with the test electrodes **21** on the semiconductor wafer **20**. After alignment, by raising the stage **200**, the semiconductor wafer **20** can be brought closer to the probe card **100**, allowing the tips of the probes **70** to contact the test electrodes **21**.

[0045] FIG. **2** is an enlarged cross-sectional view of the main part of the probe card **100** shown in FIG. **1**, detailing the structure of the main substrate **10**, the ceramic substrate **30**, and the flexible wiring board **50**.

[0046] The ceramic substrate **30** has two or more through-holes **30*h*** that penetrate in the thickness direction. A connection pin **60** is inserted into each through-hole **30*h***, allowing electrical continuity between the main substrate **10** and the flexible wiring board **50**.

[0047] The internal terminals **13** are electrodes formed on the lower surface of the main substrate **10** and are electrically connected to the external terminals **12** through wiring (not shown) on the main substrate **10**. Additionally, the internal terminals **13** are positioned corresponding to the through-holes **30*h*** and are electrically connected to the flexible wiring board **50** via the connection pins **60**.

[0048] The connection pins **60** are through-electrodes that penetrate the ceramic substrate **30** and include a shaft **61** and an electrode **62**, both integrally formed from a conductive metal. The shaft **61** is positioned within the through-hole **30*h***, with its tip protruding from the lower surface (i.e. adhesive surface) of the ceramic substrate **30**. The electrode **62** is wider than the shaft **61** and is secured to the upper surface of the ceramic substrate **30**. The electrode **62** faces the internal terminal **13** and is connected to the internal terminal **13** via solder.

[0049] The flexible wiring board **50** includes an insulating film **51** that includes two or more electrode pads **520**, two or more anchor pads **521**, and two or more through-holes **53**.

[0050] The electrode pads **520** are electrodes for mounting the probes **70** and are formed on the probe mounting surface of the flexible wiring board **50**. The electrode pads **520** are arranged to correspond to the test electrodes **21** on the semiconductor wafer **20**. Generally, numerous test electrodes **21** are arranged on the semiconductor wafer **20** at predetermined intervals. Therefore, the electrode pads **520** are also aligned and arranged at predetermined intervals.

[0051] The anchor pads **521** are protrusions formed on the adhesive surface of the flexible wiring board **50** to prevent the flexible wiring board **50** from detaching from the ceramic substrate **30**. The anchor pads **521** do not need to be conductive, but they can be formed as thin films of conductive metal, similar to the electrode pads **520**, by utilizing well-known photolithography techniques.

[0052] The anchor pads **521** are arranged corresponding to the electrode pads **520**. As a result, the protrusions formed by the anchor pads **521** are aligned on the adhesive surface of the flexible wiring board **50**. Additionally, by aligning numerous anchor pads **521** at predetermined intervals, recesses are formed between the adjacent electrode pads **520**. The anchor pads **521** have a shape corresponding to the electrode pads **520**. It is desirable for the outer edge of the electrode pad **520** to match the outer edge of the anchor pad **521**. For example, if the anchor pad **521** is symmetrical, it is preferable for the electrode pad **520** to have the same shape as the anchor pad **521**. If the anchor pad **521** is asymmetrical, it is desirable for the electrode pad **520** to have an inverted shape as seen from the backside of the anchor pad **521**.

[0053] Since the adhesive surface of the flexible wiring board **50** is formed as a smooth surface, the addition of the anchor pads **521** creates unevenness, thereby increasing the surface area in contact with the adhesive **40**. This enhances the adhesive strength and helps to prevent the flexible wiring board **50** from detaching from the ceramic substrate **30**.

[0054] When bonding the flexible wiring board **50** to the ceramic substrate **30**, any excess adhesive on the anchor pads **521** is accommodated in the recesses between the anchor pads **521**. This allows the adhesive layer between the anchor pads **521** and the ceramic substrate **30** to be relatively thinner, while also suppressing the formation of bubbles within the adhesive.

[0055] By reducing the thickness of the adhesive, it is possible to minimize variations in the thickness of the adhesive on the anchor pads **521**. This helps suppress variations in the height of the electrode pads **520** and consequently reduces variations in the height of the probes **70**. Additionally, by suppressing the formation of bubbles, the thermal expansion of bubbles during high-temperature testing and their contraction during low-temperature testing are prevented from compromising the flatness of the flexible wiring board **50**. This ensures that the height of the probes **70** remains consistent, and the tips do not shift. Therefore, it becomes possible to reliably bring two or more probes **70** into contact with the object under inspection, improving the contact reliability with the object under inspection.

[0056] The through-hole **53** is a hollow through-electrode that penetrates the flexible wiring board **50** in the thickness direction. It is made of a conductive metal, such as copper (Cu), and is formed by plating the through-holes **50***h* of the flexible wiring board **50**. Two or more through-holes **53** are aligned and arranged at predetermined intervals on the flexible wiring board **50**. The through-hole **53** includes an electrode terminal **530**, an anchor pad **531**, and an inner wall conductor **532**, forming a through-hole **53***h* surrounded by the inner wall conductor **532**.

[0057] The electrode terminal **530** is an electrode formed on the probe mounting surface of the flexible wiring board **50**. The electrode terminal **530** is formed to surround the opening of the through-hole **50***h* and is connected to the electrode pad **520** via a wiring pattern **54** on the flexible wiring board **50**.

[0058] The anchor pad **531** is a protrusion formed on the adhesive surface of the flexible wiring board **50** to prevent the flexible wiring board **50** from detaching from the ceramic substrate **30**. By forming the anchor pad **531**, unevenness is created on the adhesive surface, which increases the contact area with the adhesive **40**, thereby enhancing the adhesive strength. The anchor pad **531** has a shape corresponding to the electrode terminal **530**, for example, the same shape or an inverted shape, and is arranged corresponding to the electrode terminal **530**. Here, it is formed to surround the opening of the through-hole **50***h*.

[0059] The inner wall conductor **532** is a thin film formed on the inner wall of the through-hole **50***h*, connecting the electrode terminal **530** and the anchor pad **531** to each other. Additionally, the through-hole **50***h* is encompassed within the outer edges of both the electrode terminal **530** and the anchor pad **531**. As a result, the insulating film **51** is sandwiched between the interconnected electrode terminal **530** and anchor pad **531**, preventing the anchor pad **531** from detaching from the insulating film **51**.

[0060] The connection pin **60** is inserted into the through-hole **53***h* of the through-hole **53**, soldered to the electrode terminal **530**, and electrically connected to the through-hole **53**. As a result, the electrode pad **520** is electrically connected to the external terminal **12** via the electrode terminal **530**, the connection pin **60**, and the internal terminal **13**. Using the connection pin **60** for connection helps prevent contact failure due to adhesive contamination or misalignment during bonding. Additionally, it improves high-frequency characteristics.

[0061] FIGS. **3** and **4** show an example of the flexible wiring board **50** in a plan view, with FIG. **3** illustrating the probe mounting surface and FIG. **4** illustrating the adhesive surface.

[0062] The flexible wiring board **50** is provided with an alignment viewing hole **50***w* in the center. As shown in FIG. **3**, the probe mounting surface of the flexible wiring board **50** has electrode pads **520**, wiring patterns **54**, and electrode terminals **550** formed on it. The electrode pads **520** are aligned near the periphery of the viewing hole **50***w* along its edge. On the other hand, the electrode terminals **530** are formed near the periphery of the flexible wiring board **50** along its edge. The wiring patterns **54** connect the electrode pads **520** to the electrode terminals **530**.

[0063] As shown in FIG. **4**, anchor pads **521** and **531** are formed on the adhesive surface of the flexible wiring board **50**. The anchor pads **521** are aligned and positioned corresponding to the electrode pads **520** shown in FIG. **3**, while the anchor pads **531** are aligned and positioned corresponding to the electrode terminals **530**.

[0064] The regions a**1** to a**3** in the figure represent areas on the adhesive surface of the flexible wiring board **50**. Region a**1** is the area where the electrode pads **520** are arranged, region a**2** is the area where the electrode terminals **530** are arranged, and region a**3** is the area outside of regions a**1** and a**2**. Numerous anchor pads **521** are arranged in region a**1**, creating an uneven surface. Similarly, numerous anchor pads **531** are arranged in region a**2**, also creating an uneven surface. While it is preferable for the entire adhesive surface to be bonded to the ceramic substrate **30** via the adhesive **40**, at minimum, the first region a**1** and the second region a**2** should be bonded via the adhesive.

[0065] FIG. **5** is a view showing the adhesive layer formation area on the adhesive surface of the ceramic substrate **30**. Part (a) of the figure shows the entire adhesive surface of the ceramic substrate **30**, and part (b) provides an enlarged view of the vicinity of the through-holes **30***h*. The ceramic substrate **30** is provided with a viewing hole **30***w* corresponding to the viewing hole **50***w* of the flexible wiring board **50**. Adhesive **40** is applied to the hatched areas, forming the adhesive layer. While adhesive **40** is formed over the entire adhesive surface of the ceramic substrate **30**, designated clearance areas **40***c* are provided around the through-holes **30***h* where no adhesive **40** is applied, preventing the adhesive **40** from entering the through-holes **53***h*.

[0066] FIG. **6** is a schematic view showing an example of the manufacturing method of the probe card **100** shown in

FIG. **1**. The ceramic substrate **30** is placed with its adhesive surface facing upward by inverting its vertical orientation.

[0067] First, through-holes **30***h* are formed in the ceramic substrate **30** using a drill (FIG. **6** part (a)). Next, the connection pins **60** are inserted into the through-holes **30***h* (FIG. **6** part (b)). In this state, the electrodes **62** of the connection pins **60** are in contact with and locked against the mounting surface of the ceramic substrate **30**, while the tips of the shafts **61** protrude from the adhesive surface.

[0068] Next, an adhesive layer made of adhesive **40** is formed on the adhesive surface of the ceramic substrate **30** (FIG. **6** part (c)), and the flexible wiring board **50** is affixed (FIG. **6** part (d)). The flexible wiring board **50** is aligned so that the connection pins **60** are inserted into the through-holes **53***h*, and it is placed on the adhesive surface of the ceramic substrate **30**. It is then pressed from above to ensure that the adhesive surface adheres closely to the ceramic substrate **30**. Afterward, the adhesive **40** is cured by heating, creating a strong bond. Subsequently, the connection pins **60** are soldered to the electrode terminals **530**, and the probes **70** are soldered onto the electrode pads **520**.

[0069] It should be noted that, in this embodiment, the example of forming the adhesive layer on the adhesive surface of the ceramic substrate **30** has been described. However, it goes without saying that, alternatively, the adhesive layer may be formed on the adhesive surface of the flexible wiring board **50**.

Second Embodiment

[0070] FIG. **7** is a cross-sectional view showing an example of the main part configuration of a probe card **100** according to the second embodiment of the present invention, detailing the structure of the ceramic substrate **30**, adhesive **40**, and flexible wiring board **50**.

[0071] The electrode pads **520** and the anchor pads **521** are connected via a through-connection part **522**. The through-connection parts **522** are through-electrodes that penetrate the flexible wiring board **50**, formed by filling through-holes **52***h*, which extend through the flexible wiring board **50** in the thickness direction, with a conductive material. For example, after forming the through-holes **52***h*, the electrode pads **520**, anchor pads **521**, and through-connection parts **522** are integrally formed by plating the through-holes **52***h* with a conductive metal such as copper (Cu).

[0072] The outer edges of both sides of the through-hole **52***h* are enclosed within the outer edges of the electrode pads **520** and the anchor pads **521**, respectively. As a result, the insulating film **51** is sandwiched between the interconnected electrode pads **520** and anchor pads **521**. This configuration prevents the anchor pads **521** from detaching from the flexible wiring board **50** and also prevents the flexible wiring board **50** from detaching from the ceramic substrate **30**.

Third Embodiment

[0073] In the first and second embodiments, the example was described where anchor pads **521** are arranged in region a**1** and anchor pads **531** are arranged in region a**2** on the adhesive surface of the flexible wiring board **50**, forming unevenness in these regions a**1** and a**2**. In contrast, this embodiment describes the case where unevenness is also formed in region a**3**, which is outside of regions a**1** and a**2**.

[0074] FIGS. **8** and **9** are views showing an example of the main part configuration of a probe card **100** according to the third embodiment of the present invention. FIG. **8** is a view showing an example of the adhesive surface of the flexible wiring board **50** in a plan view, and FIG. **9** is a cross-sectional view showing the detailed structure of the ceramic substrate **30**, adhesive **40**, and flexible wiring board **50**. The probe card in this embodiment differs from the probe cards in FIGS. **4** and **7** in that two or more anchor pads **55** are arranged in region a**3**. Other configurations remain the same, and redundant explanations are omitted.

[0075] The anchor pads **55** are protrusions formed on the adhesive surface of the flexible wiring board **50** to prevent the flexible wiring board **50** from detaching from the ceramic substrate **30**. The anchor pads **55** do not need to be conductive, but they can be formed as thin films of conductive metal, similar to the electrode pads **520**, by utilizing well-known photolithography techniques.

[0076] The anchor pads **55** can take any shape and are aligned at predetermined intervals. As a result, protrusions formed by the anchor pads **55** are arranged in region a**3**, with recesses formed between the adjacent anchor pads **55**. This increases the contact area with the adhesive **40**, enhancing the adhesive strength and preventing the flexible wiring board **50** from detaching from the ceramic substrate **30**.

REFERENCE SIGNS LIST

[0077] **100** Probe card
[0078] **10** Main substrate
[0079] **11** Reinforcement plate
[0080] **12** External terminal
[0081] **13** Internal terminal
[0082] **20** Semiconductor wafer
[0083] **21** Test electrode
[0084] **30** Ceramic substrate
[0085] **30***h* Through-hole
[0086] **30***w* Viewing hole
[0087] **40** Adhesive
[0088] **40***c* Clearance area
[0089] **50** Flexible wiring board
[0090] **50***h* Through-hole
[0091] **50***w* Viewing hole
[0092] **51** Insulating film
[0093] **52***h* Through-hole
[0094] **520** Electrode pad
[0095] **521** Anchor pad
[0096] **522** Through-connection part
[0097] **53** Through-hole
[0098] **530** Electrode terminal
[0099] **531** Anchor pad
[0100] **532** Inner wall conductor
[0101] **53***h* Through-hole
[0102] **54** Wiring pattern
[0103] **55** Anchor pad
[0104] **60** Connection pin
[0105] **61** Shaft
[0106] **62** Electrode
[0107] **70** Probe
[0108] a**1**-a**3** Region

1. A probe card, comprising:

a substrate having a flat surface that faces an object under inspection;

a flexible wiring board made of an insulating film and having an adhesive surface adhered to the substrate via an adhesive and a probe mounting surface where two or more electrode pads are aligned and arranged at predetermined intervals; and

two or more probes, each disposed on a corresponding one of the two or more electrode pads, wherein

two or more first anchor pads are each formed at positions on the adhesive surface corresponding to the two or more electrode pads.

2. The probe card according to claim **1**, wherein the substrate is a ceramic substrate.

3. The probe card according to claim **1**, wherein

the electrode pads and the first anchor pads are integrally formed through first through-holes in the insulating film, and

the first through-holes are enclosed within outer edges of the electrode pads and the first anchor pads.

4. The probe card according to claim **1**, wherein the first anchor pads have a shape corresponding to the electrode pads.

5. The probe card according to any one of claims **1** to **4**, further comprising:

two or more connection pins, wherein

two or more through-holes are aligned and arranged at predetermined intervals in the substrate, each for inserting a corresponding one of the two or more connection pins,

two or more second through-holes are formed on the flexible wiring board closer to a peripheral side than the electrode pads, each for inserting a corresponding one of the two or more connection pins, and

the electrode pads are electrically connected to the connection pins.

6. The probe card according to claim **5**, wherein

two or more electrode terminals are formed on the flexible wiring board, each surrounding an opening of the two or more second through-holes on the probe mounting surface,

the connection pins are connected to the electrode terminals,

the electrode terminals are connected to the electrode pads on the flexible wiring board, and

second anchor pads are formed at positions on the adhesive surface corresponding to the electrode terminals.

7. The probe card according to claim **6**, wherein

the electrode terminals and the second anchor pads are integrally formed through the second through-holes, and

the second through-holes are enclosed within outer edges of the electrode terminals and the second anchor pads.

8. The probe card according to claim **6**, wherein two or more third anchor pads, which do not correspond to either the electrode pads or the electrode terminals, are aligned and arranged at predetermined intervals on the adhesive surface of the flexible wiring board.

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