substrates are bonded, it is necessary to reliably seal a microstructure to which a sample is introduced without damaging a microstructure such as a flow channel provided in the substrate.

[0005]

For example, Patent Literature 1 discloses "a microchip including an area to which a solution is introduced while maintaining the inner pressure of the area to be negative relative to atmospheric pressure. This microchip is formed by bonding a plurality of substrate layers made of different materials. The microchip composed of such a composite material substrate layer may have insufficient bonding strength between substrate layers.

Citation List

Patent Literature

[0006]

Patent Literature 1: JP 2011-163984A

Summary of Invention

Technical Problem

[0007]

In some case, the bonding strength between substrate layers may be insufficient depending on combination of materials of a substrate layer that constitutes a microchip. Embodiments of the present invention provide a method of manufacturing a microchip for enhancing the bonding strength between substrate layers.

Solution to Problem

[0008]

According to a first aspect of the present invention, there is provided a microchip comprising: a plurality of substrate layers; and bonding layers provided at boundary surfaces between the substrate layers and configured to include a silicon compound, wherein at least one of the bonding layers is configured to include an organic silicon compound, wherein the plurality of substrate layers include a substrate layer made of non-silicone resin and a substrate layer made of polydimethylsiloxane, and wherein both surfaces of the substrate layer made of polydimethylsiloxane are bonded to a first substrate layer made of non-silicone

resin and a second substrate layer made of non-silicone resin through the bonding layer.

~~The plurality of substrate layers may include a substrate layer made of non-silicone resin and a substrate layer made of polydimethylsiloxane. Both surfaces of the substrate layer made of polydimethylsiloxane may be bonded to a first substrate layer made of non-silicone resin and a second substrate layer made of non-silicone resin through the bonding layer.~~

The first substrate layer made of non-silicone resin may a groove on a bonding surface bonded to the substrate layer made of polydimethylsiloxane. The second substrate layer made of non-silicone resin and the substrate layer made of polydimethylsiloxane may be bonded through the bonding layer made of an organic silicon compound, the second substrate layer made of non-silicone resin has no groove on a bonding surface bonded to the substrate layer made of polydimethylsiloxane.

Further, the substrate layer made of polydimethylsiloxane may be bonded to the first substrate layer made of non-silicone resin through a bonding layer made of an inorganic silicon compound.

In addition, the substrate layer made of polydimethylsiloxane may have a groove on a bonding surface bonded to the first substrate layer made of non-silicone resin. The first substrate layer made of non-silicone resin and the second substrate layer made of non-silicone resin may have each bonded to the substrate layer made of polydimethylsiloxane through the bonding layer made of an organic silicon compound.

The first substrate layer made of non-silicone resin and the second substrate layer made of non-silicone resin may be composed of acrylic resin or polycarbonate, and may be impermeable to gas.

Further, the substrate layer made of polydimethylsiloxane may have a self-sealing ability due to elastic deformation. The groove may have an inner space which is negative pressure relative to atmospheric pressure.

[0009]

According to a second aspect of the present invention, there is provided a method for manufacturing a microchip, the method comprising: a deposition process of coating a groove forming surface of a first substrate layer made of non-silicone resin with a cross-linkable composition containing a silicon compound, the groove forming surface of the first substrate layer being provided with a groove; and a coating process of coating a surface of a second substrate layer made of non-silicone resin with a cross-linkable composition containing an

organic silicon compound, the surface of the second substrate layer being provided with no groove, and a bonding process of bonding each of the groove forming surface of the first substrate layer made of non-silicone resin and the surface of the second substrate layer made of non-silicone resin to a substrate layer made of polydimethylsiloxane.

~~The method may include a bonding process of bonding each of the groove forming surface of the first substrate layer made of non-silicone resin and the surface of the second substrate layer made of non-silicone resin to a substrate layer made of polydimethylsiloxane, the groove forming surface of the first substrate layer being coated with the cross-linkable composition containing a silicon compound, the surface of the second substrate layer being coated with the cross-linkable composition containing an organic silicon compound and provided with no groove.~~

Advantageous Effects of Invention

[0010]

According to embodiments of the present invention, there is provided a microchip having enhanced bonding strength between substrate layers.

Brief Description of Drawings

[0011]

[FIG. 1] FIGS. 1A and 1B are schematic diagrams for describing the configuration of a microchip 1a according to a first embodiment of the present technology.

[FIG. 2] FIG. 2 is a flowchart for describing a method for manufacturing the microchip 1a.

[FIG. 3] FIGS. 3A to 3F are schematic diagrams for describing a method for manufacturing the microchip 1a.

[FIG. 4] FIG. 4 is a schematic diagram for describing the configuration of a microchip 1b according to a second embodiment of the present technology.

[FIG. 5] FIG. 5 is a flowchart for describing a method for manufacturing the microchip 1b.

[FIG. 6] FIG. 6A to 6F are schematic diagrams for describing a method for

CLAIMS

~~Claim 1~~

1. A microchip comprising:

a plurality of substrate layers; and

bonding layers provided at boundary surfaces between the substrate layers and configured to include a silicon compound,

wherein at least one of the bonding layers is configured to include an organic silicon compound,

wherein the plurality of substrate layers include a substrate layer made of non-silicone resin and a substrate layer made of polydimethylsiloxane, and

wherein both surfaces of the substrate layer made of polydimethylsiloxane are bonded to a first substrate layer made of non-silicone resin and a second substrate layer made of non-silicone resin through the bonding layer.

~~Claim 2~~

~~The microchip according to claim 1,~~

~~wherein the plurality of substrate layers include a substrate layer made of non-silicone resin and a substrate layer made of polydimethylsiloxane, and~~

~~wherein both surfaces of the substrate layer made of polydimethylsiloxane are bonded to a first substrate layer made of non-silicone resin and a second substrate layer made of non-silicone resin through the bonding layer.~~

~~Claim 3~~

2. The microchip according to claim ~~2~~1,

wherein the first substrate layer made of non-silicone resin has a groove on a bonding surface bonded to the substrate layer made of polydimethylsiloxane,

wherein the second substrate layer made of non-silicone resin and the substrate layer made of polydimethylsiloxane are bonded through the bonding layer made of an organic silicon compound, the second substrate layer made of non-silicone resin has no groove on a bonding surface bonded to the substrate layer made of polydimethylsiloxane.

~~Claim 4~~

3. The microchip according to claim ~~3~~2, wherein the substrate layer made of polydimethylsiloxane is bonded to the first substrate layer made of non-silicone resin through a bonding layer made of an inorganic silicon compound.

~~Claim 5~~

4. The microchip according to claim ~~2~~1,

wherein the substrate layer made of polydimethylsiloxane has a groove on a bonding surface bonded to the first substrate layer made of non-silicone resin,

wherein the first substrate layer made of non-silicone resin and the second substrate layer made of non-silicone resin are each bonded to the substrate layer made of polydimethylsiloxane through the bonding layer made of an organic silicon compound.

~~Claim 6~~

5. The microchip according to claim 43, wherein the first substrate layer made of non-silicone resin and the second substrate layer made of non-silicone resin are composed of acrylic resin or polycarbonate.

~~Claim 7~~

6. The microchip according to claim ~~6~~5, wherein the first substrate layer made of non-silicone resin and the second substrate layer made of non-silicone resin are impermeable to gas.

~~Claim 8~~

7. The microchip according to claim ~~7~~6,

wherein the substrate layer made of polydimethylsiloxane has a self-sealing ability due to elastic deformation,

wherein the groove has an inner space which is negative pressure relative to atmospheric pressure.

~~Claim 9~~

8. A method for manufacturing a microchip, the method comprising:

a deposition process of coating a groove forming surface of a first substrate layer made of non-silicone resin with a cross-linkable composition containing a silicon compound, the groove forming surface of the first substrate layer being provided with a groove; ~~and~~

a coating process of coating a surface of a second substrate layer made of non-silicone resin with a cross-linkable composition containing an organic silicon compound, the surface of the second substrate layer being provided with no groove, and

a bonding process of bonding each of the groove forming surface of the first substrate layer made of non-silicone resin and the surface of the second substrate layer made of non-silicone resin to a substrate layer made of polydimethylsiloxane.

~~Claim 10~~

~~The method for manufacturing a microchip according to claim 9, the method comprising:~~

~~a bonding process of bonding each of the groove forming surface of the first substrate layer made of non-silicone resin and the surface of the second substrate layer made of non-silicone resin to a substrate layer made of polydimethylsiloxane, the groove forming surface of the first substrate layer being coated with the cross-linkable composition containing a silicon compound, the surface of the second substrate layer being coated with the cross-linkable composition containing an organic silicon compound and provided with no groove.~~