sample solution may be inhibited due to air existing within the wells and the like, and it may take a long time to introduce the sample. In addition, when a sample solution is introduced, air voids may be generated within wells and the like. Consequently, the amounts of the sample solution introduced into the wells vary, thus resulting in a lowering of the precision or efficiency of analysis. When a sample is heated, as in PCR, air voids remaining in wells expand, which inhibits the reaction or decreases the precision of analysis.

[0008] In order to easily introduce the sample solution in the micro-TAS, for example, Patent Literature 2 discloses a "substrate including at least a sample-introducing part for introducing the samples, a plurality of storing parts for storing the samples, and a plurality of air-discharging parts connected to the storing parts, in which two or more of the air-discharging parts are communicated with one open channel having one opened terminal." In this substrate, the air-discharging part is connected to each of the storing parts, and therefore when the sample solution is introduced from the sample-introducing part to the storing parts, the air existing in the storing parts is discharged from the air-discharging parts, with the result that the sample solution can smoothly be filled into the storing parts.

Citation List

Patent Literature

[0009] PTL 1: Japanese Patent Application Laid-open No. 2004-219199
PTL 2: Japanese Patent Application Laid-open No. 2009-284769

Summary of Invention

[0010] As stated above, according to the known micro-TAS, it is difficult to introduce a sample solution into wells or a flow passage, the introduction of the sample solution may be inhibited due to air existing within wells and the like, and it may take a long time to introduce a sample. In addition, when the sample solution is introduced, air voids may be generated within wells and the like. For these reasons, problems arise in the precision or efficiency of analysis.

[0011] It is desirable to provide a microchip capable of easily introducing a sample solution in a short time, and obtaining the high precision of analysis.

[0012] In a first aspect, there is provided a microchip comprising a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel, wherein the substrate structure includes two substrate layers and at least one self-sealing substrate layer disposed between the two substrate layers, wherein the self-sealing substrate layer is configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

[0012a] In an embodiment, a microchip is provided. The microchip includes a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel.

[0013] In an embodiment, the fluid channel is configured to analyze the sample solution.

[0014] In an embodiment, the substrate structure includes at least one substrate layer that includes an elastic material.

[0015] In an embodiment, the elastic material includes at least one constituent selected from the group consisting of a silicone elastomer including polydimethyl siloxane, an acrylic elastomer, a urethane elastomer, a fluorine-containing elastomer, a styrene elastomer, an epoxy elastomer, and a natural rubber.

[0016] In an embodiment, the substrate structure includes at least one self-sealing substrate layer configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

[0017] In an embodiment, the substrate structure includes at least one gas-impermeable substrate layer.

[0018] In an embodiment, the gas-impermeable substrate layer includes any one of a plastic material, a metal, and a ceramic.

[0019] In an embodiment, the fluid channel includes at least one injection site; at least one fluid well; and at least one fluid flow passage.

[0020] In an embodiment, the at least one injection site is configured for puncture-injecting the sample solution into the substrate structure; wherein the at least one fluid well is configured to contain the sample solution or a reaction product thereof; and wherein the at least one fluid flow passage is configured to allow flow of the sample solution in fluid communication with the at least one injection site and the at least one fluid well.

[0021] In a second aspect, there is provided a method of manufacturing a microchip, the method comprising forming a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel, wherein the step of forming a substrate structure comprises providing at least one self-sealing substrate layer disposed between two substrate layers, wherein the self-sealing substrate layer is configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

[0021a] In another embodiment, a method of manufacturing a microchip is provided. The method includes forming a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel.

[0022] In an embodiment, the fluid channel is configured to analyze the sample solution.

[0023] In an embodiment, the substrate structure includes at least one substrate layer that includes an elastic material.

[0024] In an embodiment, the elastic material includes at least one constituent selected from the group consisting of a silicone elastomer including polydimethyl siloxane, an acrylic elastomer, a urethane elastomer, a fluorine-containing elastomer, a styrene elastomer, an epoxy elastomer, and a natural rubber.

[0025] In an embodiment, the substrate structure includes at least one self-sealing substrate layer configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

[0026] In an embodiment, the substrate structure includes at least one gas-impermeable substrate layer.

[0027] In an embodiment, the gas-impermeable substrate layer includes any one of a plastic material, a metal, and a ceramic.

[0028] In an embodiment, the fluid channel includes at least one injection site; at least one

CLAIMS

1. A microchip comprising a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel,

wherein the substrate structure includes two substrate layers and at least one self-sealing substrate layer disposed between the two substrate layers, wherein the self-sealing substrate layer is configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

2. The microchip of claim 1, wherein the fluid channel is configured to analyze the sample solution.

3. The microchip of claim 1, wherein the substrate structure includes at least one substrate layer that includes an elastic material.

4. The microchip of claim 3, wherein the elastic material includes at least one constituent selected from the group consisting of a silicone elastomer including polydimethyl siloxane, an acrylic elastomer, a urethane elastomer, a fluorine-containing elastomer, a styrene elastomer, an epoxy elastomer, and a natural rubber.

5. The microchip of claim 1, wherein the substrate structure includes at least one gas-impermeable substrate layer.

6. The microchip of claim 5, wherein the gas-impermeable substrate layer includes any one of a plastic material, a metal, and a ceramic.

7. The microchip of claim 1, wherein the fluid channel includes at least one injection site; at least one fluid well; and at least one fluid flow passage.

8. The microchip of claim 7, wherein the at least one injection site is configured for puncture-injecting the sample solution into the substrate structure; wherein the at least one fluid well is configured to contain the sample solution or a reaction product thereof; and wherein the at least one fluid flow passage is configured to allow flow of the sample solution in fluid communication with the at least one injection site and the at least one fluid well.

9. A method of manufacturing a microchip, the method comprising forming a substrate structure including a fluid channel configured to contain a sample solution, wherein the fluid channel is maintained at a pressure lower than atmospheric pressure prior to injection of the sample solution into the fluid channel,

wherein the step of forming a substrate structure comprises providing at least one self-sealing substrate layer disposed between two substrate layers, wherein the self-sealing substrate layer is configured to allow self-sealing of the substrate structure subsequent to injection of the sample solution.

10. The method of claim 9, wherein the fluid channel is configured to analyze the sample solution.

11. The method of claim 9, wherein the substrate structure includes at least one substrate layer that includes an elastic material.

12. The method of claim 11, wherein the elastic material includes at least one constituent selected from the group consisting of a silicone elastomer including polydimethyl siloxane, an acrylic elastomer, a urethane elastomer, a fluorine-containing elastomer, a styrene elastomer, an epoxy elastomer, and a natural rubber.

13. The method of claim 9, wherein the substrate structure includes at least one gas-impermeable substrate layer.

14. The method of claim 13, wherein the gas-impermeable substrate layer includes any one of a plastic material, a metal, and a ceramic.

15. The method of claim 9, wherein the fluid channel includes at least one injection site; at least one fluid well; and at least one fluid flow passage.

16. The method of claim 15, wherein the at least one injection site is configured for puncture-injecting the sample solution into the substrate structure; wherein the at least one fluid well is configured to contain the sample solution or a reaction product thereof; and wherein the at least one fluid flow passage is configured to allow flow of the sample solution in fluid communication with the at least one injection site and the at least one fluid well.