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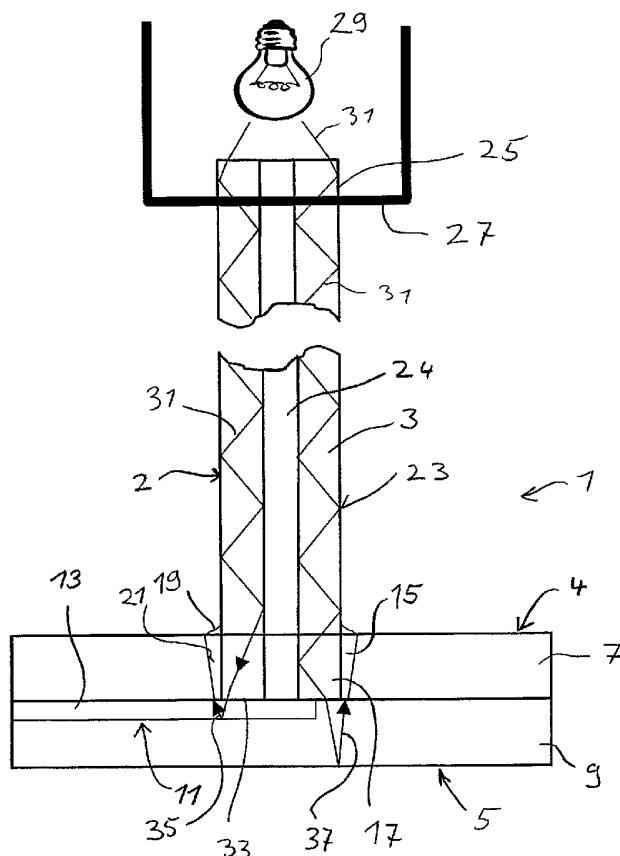
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(54) Title: GLUEING TWO PARTS BY STOPPING A LIQUID ADHESIVE



(57) Abstract: A method of glueing a first part (2) to a second part (4) with a liquid light hardening adhesive. Firstly, the adhesive (19) is applied. Subsequently, a flow of the adhesive is stopped by emitting light. Besides this, a microfluidic arrangement is suggested. The microfluidic arrangement has a microfluidic assembly (1; 39; 49) with a capillary (3; 41; 51). The capillary (3; 41; 51) of the assembly (1; 39; 49) is optically coupled to a light source (29).



— with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

GLUEING TWO PARTS BY STOPPING A LIQUID ADHESIVE

BACKGROUND ART

[0001] The present invention relates to a method of gluing a first part to a second
5 part with a liquid light hardening adhesive.

[0002] Liquid light hardening adhesives can be used for gluing a variety of various
parts together. The liquid adhesives can be applied to the parts and light-hardened
thereafter for gluing them together. Capillaries, for example, can be typically coupled to
microfluidic systems, for example microfluidic chips, by gluing with a light hardening
10 adhesive. The capillary can be connected to a flow path of the microfluidic system and
be used for interconnecting the microfluidic system with other devices, for example a
laboratory apparatus or an automatic sampler. Known in the art microfluidic devices
comprise at least two layers. The layers can comprise a plastic material, for example
polyimide, or a transmissible material, for example glass. Typically one of the layers
15 comprises a microfluidic structure comprising the flow path to be connected to the
capillary.

DISCLOSURE OF THE INVENTION

[0003] It is an object of the invention to provide an improved gluing of a first part to
a second part, in particular to provide an improved coupling of a capillary to a flow
20 path. The object is achieved by the independent claims. Preferred embodiments are
shown by the dependent claims.

[0004] The invention relates to a method of gluing a first part to a second part with a
liquid light hardening adhesive. As a first step, the adhesive is applied. Thereafter, a
flow of the adhesive is stopped by emitting light. The emitted light is adapted for light
25 hardening the adhesive. Advantageously, the flow of the adhesive can be stopped by
hardening it by the emitted light, before the flow of the adhesive reaches sensitive
elements of the parts to be glued together. The sensitive parts can be protected
against any undesired soiling caused by the adhesive.

[0005] Embodiments may include one or more of the following. At least one of the parts is transmissible for the light. At least one spot can be lit by the emitted light, for example a spot located close to a sensitive element of one of the parts. For connecting the first part – for example a capillary or an optical wave guide – to the second part –
5 for example a microfluidic system – the microfluidic system can comprise a hole. The hole can be connected to a flow path of the microfluidic system. The flow path of the microfluidic system is very sensitive against any soiling by the adhesive because this can lead to an undesired clogging of the flow path. For coupling the capillary to the flow path, the capillary can be glued into the hole by the adhesive as follows. As a first
10 step, the capillary can be inserted into the hole being coupled to the flow path. After that, light can be emitted through a light exit being located close to the hole and close to the flow path. Finally, the adhesive can be applied into the hole. The light is still emitted while applying the adhesive.

[0006] Besides this, the light can be guided through an optical wave guide before
15 being emitted through the light exit. Advantageously, the capillary and/or the microfluidic structure, for example the flow path, of the microfluidic device can act as an optical wave guide.

[0007] The hole can be part of a first layer of the microfluidic device. The microfluidic device can comprise a second layer comprising the flow path. The flow
20 path is connected to the hole. The hole of the first layer of the microfluidic device can be applied by any suited method, for example by powder blasting, by ultrasonic drilling, by drilling, or alike. Besides this, the microfluidic device can be designed as a microfluidic chip and can comprise one or more microfluidic functional elements, such as flow paths, valves, detection areas, ports, or alike.

[0008] Advantageously, the hole can be conically shaped, wherein the hole widens
25 towards the outside of the device. The capillary can be inserted into the hole and the adhesive can be applied into the clearance between the capillary and the hole. Advantageously, the adhesive is a light-hardening adhesive, in particular an ultraviolet light hardening adhesive. The adhesive can flow within the clearance between the
30 capillary and the hole from the outside of the device towards the flow path. The light

exit is located close to the hole and close to the flow path.

[0009] Advantageously, the flow of the adhesive can be stopped before it reaches the flow path by light hardening as soon as the flow of the adhesive reaches the light exit. In other words, as soon as the flow of the adhesive reaches the emitted light, the adhesive is hardened stopping any further flow of the adhesive.

[0010] Advantageously, the flow within the clearance between the capillary and the hole can be controlled by the intensity of the light emitted through the light exit. For an optimum dimensioning, the clearance, the intensity of the light, and the hardening time of the adhesive can be adjusted, so that the flow of the adhesive within the clearance between the capillary and the hole stops exactly before reaching the flow path. This guarantees a minimal death volume within the microfluidic system respectively at the coupling point of capillary and flow path. Besides this, any clogging of the flow path can be avoided by stopping the flow of the adhesive towards the flow path. The adhesive is flowing within the hole respectively within the clearance between the hole and the capillary after and/or while applying it to the hole and the capillary. The flow of the adhesive can be stopped before reaching the flow path. This can be achieved by hardening the adhesive at least partly by the emitted light or rather by controlling the flow of the adhesive at the coupling point respectively at the light exit.

[0011] Embodiments may comprise one or more of the following. Advantageously, the end of the capillary being inserted into the hole can comprise the light exit. Advantageously, the capillary can act as a light guide. Light can be coupled to the capillary for being emitted through the light exit. Advantageously, capillaries normally comprise, respectively consist of, light-guiding material. The end not being inserted into the hole can be coupled to a light source, for example an ultraviolet light source. Because of the light guiding characteristic of the capillary, the light can exit only at the end of the capillary being inserted into the hole and being located closely to the flow path. The adhesive can flow within the clearance between the hole and the capillary until it reaches the end of the capillary being located close to the flow path. Reaching this point the emitted light hardens the adhesive automatically.

[0012] Embodiments may comprise one or more of the following. Advantageously,

the light exit or rather the end of the capillary can comprise a chamfer. The chamfer can realize the light exit or an additional light exit. The chamfer can direct the emerging beam towards the inner surface of the hole. By this, the emitted light can be directed towards the flow of the adhesive.

5 [0013] The same effect can be reached by a groove. The groove can be inserted as an uninterrupted groove at the outer surface of the capillary with a distance to the flow path. Advantageously, the uninterrupted groove of the capillary is positioned within the hole. Advantageously, a small amount of the adhesive can flow past the uninterrupted groove without clogging the flow path. It is thus possible to use an adhesive with a
10 compared longer hardening time.

[0014] Embodiments may comprise one or more of the following. Advantageously, a first part of the adhesive being located close to the light exit is hardened after applying the adhesive. This hardened first part of the adhesive realizes a cut off for the flowing adhesive. After that, a second part respectively the rest of the adhesive can be
15 hardened, for example by exposing the interface between the capillary and the hole of the device to a light source.

[0015] Another aspect of the present invention relates to a microfluidic assembly comprising a microfluidic device and a capillary. The microfluidic device comprises a flow path. The capillary is coupled to the flow path of the microfluidic device. The
20 capillary comprises a light exit being located close to the flow path of the microfluidic device. Embodiments may comprise one or more of the following. Advantageously, such a device can be produced without causing any clogging of the flow path. The light exit can comprise an uninterrupted groove and/or a chamfer.

[0016] A further aspect of the present invention relates to a microfluidic
25 arrangement comprising a microfluidic assembly with a capillary. The capillary of the assembly is optically coupled to a light source.

BRIEF DESCRIPTION OF DRAWINGS

[0017] Other objects and many of the attendant advantages of embodiments of the present invention will be readily appreciated and become better understood by

reference to the following more detailed description of preferred embodiments in connection with the accompanied drawings. Features that are substantially or functionally equal or similar will be referred to with the same reference sign(s).

[0018] Fig. 1 shows a schematic sectional side view of a capillary being coupled to a microfluidic device comprising a flow path;

[0019] Fig. 2 shows a partly schematic sectional side view of the device of fig. 1 being coupled to a capillary comprising a chamfer;

[0020] Fig. 3 shows a schematic sectional side view of the device of fig. 1 being coupled to a capillary comprising an uninterrupted groove.

[0021] Fig. 1 shows a schematic sectional side view of an assembly 1 with a first part 2, a capillary 3, and a second part 4, a microfluidic device 5. The capillary 3 is coupled to the microfluidic device 5. The microfluidic device 5 comprises a first layer 7 and a second layer 9. The second layer 9 of the microfluidic device 5 comprises a microfluidic structure 11 comprising at least one flow path 13. The first layer 7 of the microfluidic device 5 of the assembly 1 comprises a hole 15. The hole 15 can be conically shaped and tapered towards the flow path 13 of the second layer 9 of the microfluidic device 5. Any other shape of the hole 15 is possible. The hole 15 is inserted into the first layer 7 of the microfluidic device 5 as a through hole and can be realized by powder blasting, ultrasonic drilling, drilling, or alike. The capillary 3 of the assembly 1 comprises a first end 17 being inserted into the hole 15 of the first layer 7 of the microfluidic device 5. The capillary 3 of the assembly 1 or rather the first end 17 of the capillary 3 is glued into the hole 15 by an adhesive 19. For gluing the capillary 3 into the hole 15 of the first layer 7, the adhesive 19 can be filled into the clearance between an inner surface 21 of the hole 15 and an outer surface 23 of the capillary 3.

[0022] The capillary 3 comprises a channel 24 routing from the first end 17 to a second end 25 of the capillary 3. The second end 25 of the capillary 3 is coupled to an aperture 27 of an ultraviolet light source 29 for coupling light into the capillary 3. It can be seen, that the capillary 3 is used as a light guide. The light being coupled into the capillary 3 is captured in the capillary 3 as symbolized by reflected beams 31 of the

light source 29. Consequently, the capillary 3 realizes an optical wave guide. The first end 17 of the capillary 3 of the assembly 1 realizes a light exit 33 for the light or rather the beams 31 of the ultraviolet light source 29. The beams 31 emerge through the light exit 33. The light being emitted through the light exit 33 can be used for lighting the clearance between the inner surface 21 of the hole 15 and the outer surface 23 of the capillary 3, as symbolized with a first reflected beam 35 and a second reflected beam 37.

[0023] In this embodiment, the layers 7 and 9 of the microfluidic device 5 comprise a transmissible and reflecting material, for example quartz glass. The microfluidic structure 11 of the second layer 9 of the microfluidic device 5 can be realized by etching. Advantageously, quartz glass reflects light from outside and inside on its surfaces. The beam 35 is reflected by a surface of the flow path 13 of the microfluidic structure 11 of the second layer 9. The second beam 37 is reflected on the inside of a surface of the second layer 9 and directed towards the clearance between the inner surface 21 of the hole 15 and the outer surface 23 of the capillary 3. As soon as any adhesive reaches the points or the spots lit by the beams 35 and 37 it can be light-hardened for stopping the flow of adhesive within the clearance before reaching the flow path 13. By this, any clogging of the flow path 13 by any adhesive can be avoided. The direction of the flow of the adhesive is indicated by an arrow 38.

[0024] Fig. 2 shows a partly schematic sectional side view of an assembly 39 with a capillary 41. In difference, the capillary 41 of the assembly 39 comprises a chamfer 43. The chamfer 43 realizes an additional light exit 45 as indicated by a reflected beam 47. The beam 47 is directed towards the inner surface 21 of the hole 15 and is reflected at the outer surface of the second layer 9. Advantageously, the point close to the flow path 13 can be lit directly by light emerging from the additional light exit 45 of the capillary 41 realized by the chamfer 43. Any flowing adhesive can be lit and by this stopped before reaching the flow path 13 of the microfluidic device 5.

[0025] Fig.3 shows a partly schematic sectional side view of another assembly 49 comprising a capillary 51 with an uninterrupted groove 53. The uninterrupted groove 53 of the capillary 51 is located at the first end 17 of the capillary 51 of the assembly

49. The uninterrupted groove 53 is located within the hole 15 of the first layer 7 of the microfluidic device 5. Advantageously, the groove 53 of the capillary 51 realizes an additional light exit 55 for lighting the clearance within the hole 15 as symbolized by a reflected beam 57. Advantageously, any adhesive flowing within the clearance of the hole 15 can flow past the groove 53. If the adhesive reaches the groove 53 it can be light-hardened by light being emitted through the groove 53 or rather through the light exit 55 realized by the groove 53. The position of the groove 53 or rather the distance of the groove 53 to the flow path 13 of the microfluidic device 5 can be adjusted, so that a little bit of the adhesive can flow past the groove 53 without clogging the flow path 7. The flow of the adhesive can be stopped at the light exit 55 and additionally at the light exit 33 as described above.

[0026] In a not shown embodiment, the layers 7 and/or 9 of the microfluidic device 5 can comprise a light exit. For lighting the coupling point, light can be coupled in the layers 7 and/or 9.

[0027] Possibly, the capillary 3 comprises a bevel or any other recess being located close to the flow path 13 realizing an additional light exit.

[0028] In the following a method of gluing a first part 2 to a second part 4 with a light hardening adhesive 19 is described by referring to the Figures 1, 2, and 3.

[0029] In a first step, the adhesive 19 is applied to the parts 2, 4 or rather to at least one of the parts 2, 4. Thereafter, a flow of the adhesive 19 is stopped by emitting light. The emitted light respectively the frequency band of the light is adapted for light hardening the adhesive 19. Preferably, the parts 2, 4 are positioned relative to each other before applying the adhesive 19. In embodiments, the light can be emitted through a light exit 33, 45 or 55. By this, the emit rays can be directed more precisely towards the flowing adhesive. Advantageously, the flow of the adhesive can be stopped close to the light exit, in particular at a spot being lit.

[0030] In other embodiments, the first part 2 is a capillary 3, 41, or 51 and the second part is a microfluidic device 5 comprising a flow path 13. The capillary 3 can be inserted into a hole 15 of the microfluidic device 5 being coupled to the flow path 13 of

the microfluidic device 5. Subsequently, light can be emitted through the light exit 33, or rather the light exit 45 or rather the light exit 55 of the capillary 3 or rather the capillary 41 or rather the capillary 51. Finally, an adhesive 19 is applied into the hole 15.

5 [0031] In further embodiments, the flow of the adhesive 19 within the hole 15 towards the flow path 13 is stopped before the adhesive reaches the flow path 13. The flow can be stopped by the emitted light. The light has to be emitted at least until the applied adhesive reaches a point being lit by the emitted light.

10 [0032] Applying the adhesive induces a flow within the hole 15. The induced flow of the adhesive 19 can be stopped after and/or while applying. More precisely, the flow can be stopped after and/or while reaching a point being lit by the emitted light as symbolized by the beams 35 or rather 37, or rather 47, or rather 57. Without the emitted light, the flow of the adhesive would reach the flow path 13. This would lead to an undesired clogging of the flow path 13. Possibly, the light can be emitted a short
15 time before the adhesive reaches the flow path 13.

[0033] Before starting the steps as described above, the first end 17 of the capillary 3 can be inserted into the hole 15 of the second layer 9 of the microfluidic device 5. The first end 17 of the capillary 3 comprises the light exit 33, 45, and/or 55. Subsequently, light, preferably ultraviolet light can be coupled into the capillary 3 by
20 the aperture 27 being coupled to the light source 29. By this, the light can be captured in the capillary 3 and guided to the light exit(s) 33, 45, and/or 55 of the capillary 3.

[0034] Advantageously, the light exit(s) 33, 45, and/or 55 can be realized by the end 17, a chamfer 43 and/or a groove 53 of the capillary.

25 [0035] The light emerging through the light exit 33 of the capillary 3 can be reflected by the second layer 9 of the microfluidic device 5 and directed into the clearance of the hole 15. This makes it possible to harden a first part of the adhesive being located close to the light exit 33. This step can be executed after and/or while applying the adhesive into the clearance of the hole 15. As soon as any adhesive reaches the light exit of the capillary 3 or rather the lit point within the clearance between the inner

surface 21 of the hole 15 and the outer surface 23 of the capillary 3, the adhesive 19 or rather the first part of the adhesive 19 can be hardened. This hardened first part can realize a plug-up for stopping the flow of the adhesive 19 within the clearance of the hole 15. For this purpose the adhesive 19 is an ultraviolet light-hardening adhesive.

5 Advantageously, the capillary 3 can comprise one or more of the light exits 33, 45, and/or 55 for realizing one or more plug-ups.

[0036] After hardening the first part of the adhesive 19, the rest of the adhesive 19 can be hardened. This can be done, for example, by lighting the assembly 1 or rather the hole 15 with the capillary 3 directly with the ultraviolet light source 29.

10 [0037] Advantageously, the first part of the adhesive being located close to the first end 17 of the capillary 3 or rather to the light exit 33 or rather to the chamfer 43 or rather to the uninterrupted groove 53 can be hardened.

[0038] Possibly, any other part, for example a layer 7, 9 of the microfluidic device 5 can comprise a light exit. In this case, the light emitted by the light source 29 can be
15 coupled into the layer 7 and/or 9 of the microfluidic device 5 and transported within the layer 7 and/or 9 or rather within the microfluidic structure of the layer 7 and/or 9 to the light exit of the layer 7 and/or 9.

[0039] Besides this, it is possible, to glue an optical wave guide to any other part, for example an optical component, for example a diode or a laser diode, by executing
20 the method as described above.

[0040] Finally, it is possible, to glue more than two parts together, by executing the method as described above.

[0041] The microfluidic device 5 is adapted for executing at least one microfluidic process, for example an electrophoresis and/or a liquid chromatographic process, for
25 example a high performance liquid chromatographic process (HPLC). Therefore, the microfluidic device 5 can be coupled to a liquid delivery system, in particular to a pump, and/or to a power source. For analyzing the liquid or rather one or more components within the liquid, the microfluidic device 5 can comprise a detection area, such as an optical detection area and/or an electrical detection area being arranged

close to a flow path within the microfluidic device 5. Otherwise, the microfluidic device 5 can be coupled to a laboratory apparatus, for example to a mass spectrometer, for analyzing the liquid. For executing an electrophoresis, the flow path can comprise a gel. Besides this, the microfluidic device 5 can be a component part of a laboratory arrangement.

[0042] It is to be understood that this invention is not limited to the particular component parts of the devices described or to process steps of the methods described as such devices and methods may vary. It is also to be understood, that the terminology used herein is for the purposes of describing particular embodiments only and it is not intended to be limiting. It must be noted that, as used in the specification and the appended claims, the singular forms of "a", "an", and "the" include plural referents until the context clearly dictates otherwise. Thus, for example, the reference to "a capillary" or "a light exit" includes two or more such functional elements.

CLAIMS

1. A method of gluing a first part (2) to a second part (4) with a liquid light hardening adhesive (19), comprising the steps of:
 - applying the adhesive (19),
 - 5 - stopping a flow of the adhesive by emitting light.
2. The method of claim 1 or any one of the above claims, wherein at least one of the parts (2,4) is transmissible for the light.
3. The method of claim 1 or any one of the above claims, including the additional step of:
 - 10 - stopping the flow of the adhesive (19) at a spot being lit.
4. The method of claim 1 or any one of the above claims, including the additional step of:
 - guiding the light through an optical wave guide.
5. The method of claim 1 or any one of the above claims, including the additional step of:
 - 15 - emitting or starting emitting the light through a light exit (33;45;55), in particular guiding the light through the optical wave guide before emitting the light through the light exit (33;45;55).
6. The method of claim 1 or any one of the above claims, including the additional step of:
 - 20 - positioning the two parts (2,4) before applying the adhesive (19) to the parts (2,4).
7. The method of claim 1 or any one of the above claims, including the additional step of:
 - 25 - stopping the flow of the adhesive (19) close to the light exit (33;45;55).
8. The method of claim 1 or any one of the above claims, wherein the first part (2) is a capillary (3;41;51), and wherein the second part (4) comprises a flow path (13), including the additional step of:

- coupling the capillary (3;41;51) to the flow path (13).

9. The method of claim 8 or any one of the above claims, wherein the capillary (3;41;51) and/or the flow path (13) realize the optical wave guide.

10. The method of claim 8 or any one of the above claims, including the additional step of:

- inserting the capillary (3;41;51) into a hole (15) being coupled to the flow path (13).

11. The method of claim 10 or any one of the above claims, including the additional step of:

- emitting light through the light exit (33;45;55), wherein the light exit (33;45;55) is located close to the hole (15) and close to the flow path (13).

12. The method of claim 10 or any one of the above claims, including the additional step of:

- applying the adhesive (19) into the hole (15).

13. The method of claim 10 or any one of the above claims, including the additional step of:

- stopping the flow of the adhesive (19) within the hole (15) towards the flow path (13) before reaching the flow path (13) by the emitted light after or while applying the adhesive (19).

14. The method of claim 10 or any one of the above claims, including the additional step of:

- inserting a first end (17) of the capillary (3;41;51) into the hole, wherein the first end (17) of the capillary (3;41;51) comprises the light exit (33;45;55).

15. The method of the above claim, including the additional step of

- coupling light, in particular light from a light source (29), into the capillary (3;41;51) for emitting light through the light exit (33;45;55) of the capillary (3;41;51).

16. The method of claim 5 or any one of the above claims, wherein the light exit

(45) comprises a chamfer (43).

17. The method of claim 5 or any one of the above claims, wherein the light exit (55) comprises a groove, in particular an uninterrupted groove (53).

18. The method of claim 5 or any one of the above claims, including the additional
5 step of

- hardening at least one first part of the adhesive (19) being located close to the light exit (33;45;55) after applying the adhesive (19).

19. The method of claim 5 or any one of the above claims, including the additional
step of:

10 - hardening the first part of the adhesive (19) being located close to the light exit (33;45;55) while applying the adhesive (19).

20. The method of any one of the above two claims, including the additional step
of:

15 - hardening a second part respectively the rest of the adhesive (19) after hardening the first part.

21. The method of claim 18 or 19 or any one of the above claims, including the
additional step of hardening the first part of the adhesive (19) being located
close to the end of the capillary (3;41;51).

22. The method of claim 18 or 19 or any one of the above claims, including the
20 additional step of hardening the first part of the adhesive (19) being located close to the chamfer (43).

23. The method of claim 18 or 19 or any one of the above claims, including the
additional step of hardening the first part of the adhesive (19) being located close
to the uninterrupted groove (53).

25 24. A microfluidic assembly (1;39;49) comprising a microfluidic device (5) and a capillary (3;41;51), wherein the microfluidic device (5) comprises a flow path (13), wherein the capillary (3;41;51) is coupled to the flow path (13) of the microfluidic device (5), wherein the assembly (1;39;49) comprises a light exit (33;45;55)

being located close to the flow path (13) of the microfluidic device (5).

25. The microfluidic assembly of the above claim, wherein the capillary (3;41;51) comprises the light exit (33;45;55).

26. The microfluidic assembly (1;39;49) of claim 24 or any one of the above claims,
5 wherein the light exit (33;45;55) comprises an uninterrupted groove (53) and/or a chamfer (43).

27. A microfluidic arrangement comprising a microfluidic assembly (1;39;49) of claim 24 or any one of the above claims, wherein the capillary (3;41;51) of the assembly (1;39;49) is optically coupled to a light source (29).

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original claims 1 to 27 replaced by amended claims 1 to 11]

+ statement

CLAIMS

1. A method of gluing a first part (2) to a second part (4) with a liquid light
hardening adhesive (19), wherein the first part (2) is a capillary (3;41;51), the
second part (4) comprises a flow path (13), and the capillary (3;41;51) and/or
5 the flow path (13) provide an optical wave guide, the method comprising the
steps of:
 - coupling the capillary (3;41;51) to the flow path (13),
 - applying the adhesive (19),
 - stopping a flow of the adhesive by emitting light and guiding the light through
10 the optical wave guide.
2. The method of claim 1, comprising at least one of the steps of:
 - stopping the flow of the adhesive (19) at a spot being lit;
 - positioning the two parts (2,4) before applying the adhesive (19) to the parts
(2,4);
 - 15 - stopping the flow of the adhesive (19) close to the light exit (33;45;55).
3. The method of claim 1 or any one of the above claims, further comprising the
step of:
 - inserting the capillary (3;41;51) into a hole (15) being coupled to the flow path
(13).
- 20 4. The method of claim 3, comprising at least one of the steps:
 - emitting light through the light exit (33;45;55), wherein the light exit (33;45;55)
is located close to the hole (15) and close to the flow path (13);
 - applying the adhesive (19) into the hole (15);
 - stopping the flow of the adhesive (19) within the hole (15) towards the flow path
25 (13) before reaching the flow path (13) by the emitted light after or while
applying the adhesive (19);
 - inserting a first end (17) of the capillary (3;41;51) into the hole, wherein the first

end (17) of the capillary (3;41;51) comprises the light exit (33;45;55);

- inserting a first end (17) of the capillary (3;41;51) into the hole, wherein the first end (17) of the capillary (3;41;51) comprises the light exit (33;45;55), and coupling light, in particular light from a light source (29), into the capillary (3;41;51) for emitting light through the light exit (33;45;55) of the capillary (3;41;51).

5. The method of claim 1 or any one of the above claims, including the additional step of:

- emitting or starting emitting the light through a light exit (33;45;55), in particular guiding the light through the optical wave guide before emitting the light through the light exit (33;45;55);

6. The method of claim 5, comprising at least one of the features:

the light exit (45) comprises a chamfer (43);

the light exit (55) comprises a groove, in particular an uninterrupted groove (53);

7. The method of claim 5 or any one of the above claims, comprising at least one of the steps: - hardening at least one first part of the adhesive (19) being located close to the light exit (33;45;55) after applying the adhesive (19);

- hardening the first part of the adhesive (19) being located close to the light exit (33;45;55) while applying the adhesive (19).

8. The method of claim 7, comprising at least one of the steps:

- hardening a second part respectively the rest of the adhesive (19) after hardening the first part;

- hardening the first part of the adhesive (19) being located close to the end of the capillary (3;41;51);

- hardening the first part of the adhesive (19) being located close to the chamfer (43);

- hardening the first part of the adhesive (19) being located close to the uninterrupted groove (53).

5 9. A software program or product, preferably stored on a data carrier, for controlling the method of claim 1 or any one of the above claims, when run on a data processing system such as a computer.

10 10. A microfluidic assembly (1;39;49) comprising a microfluidic device (5) and a capillary (3;41;51), wherein the microfluidic device (5) comprises a flow path (13), the capillary (3;41;51) is coupled to the flow path (13) of the microfluidic device (5), the capillary (3;41;51) and/or the flow path (13) provide an optical wave guide, and the assembly (1;39;49) comprises a light exit (33;45;55) being located close to the flow path (13) of the microfluidic device (5) in order to stop a flow of an adhesive by emitting light and guiding the light through the optical wave guide.

11. The microfluidic assembly of the above claim, comprising at least one of the features:

15 the capillary (3;41;51) comprises the light exit (33;45;55);

the light exit (33;45;55) comprises an uninterrupted groove (53) and/or a chamfer (43);

the capillary (3;41;51) of the assembly (1;39;49) is optically coupled to a light source (29).

3) Novelty and Inventiveness

D1 discloses the making of a fluid connection between a capillary and a micro-engineered structure. A flow of liquid sealant is provided in order to secure the capillary to a flow channel. The structure requires the capillary to be provided parallel to the flow channel and in particular that the structure comprises a glass substrate cover, allowing to irradiate light through the transparent glass substrate field in order to harden the liquid sealant.

According to the present invention, the capillary and/or the flow part provide an optical wave guide, thus allowing to guide the light through the optical wave guide in order to stop a flow of the adhesive for gluing the capillary to the second part. Such provision of an optical wave guide is neither disclosed nor hinted in D1 and opens a variety of entirely different applications and structures with respect to D1. In particular, as apparent from the figures of the present invention in contrast to e.g. figure 2 of D1, the invention is not limited to a structure where the capillary is arranged in parallel to the flow part but also allows to safely guide the light even in a vertical arrangement as shown in figure 1 of the invention. Further, the invention is not limited to micro structures having a transparent glass cover.

Since the features of claim 1 are neither disclosed nor can be obviously derived from D1, claim 1 (and accordingly claim 10) is new and involves an inventive step.

On behalf of Agilent Technologies, Inc.



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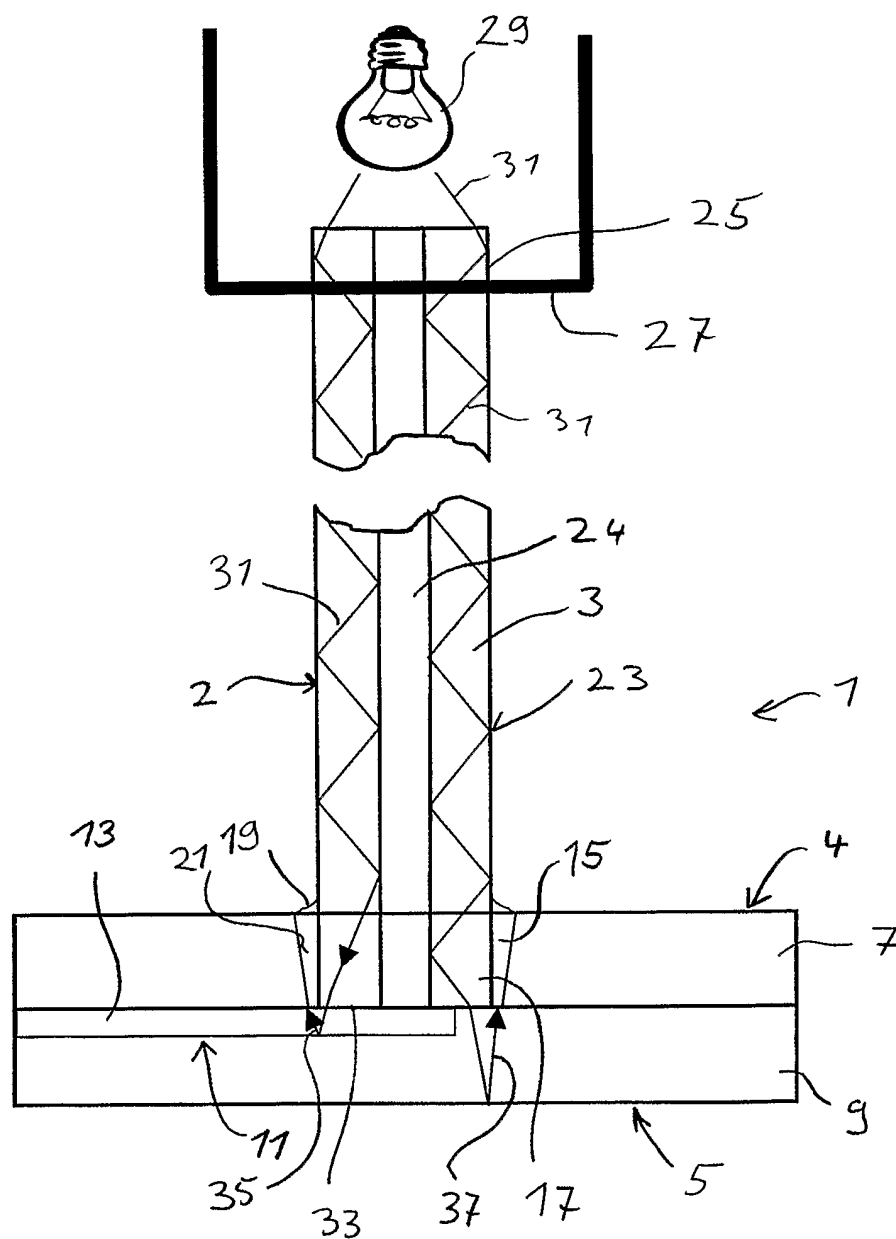
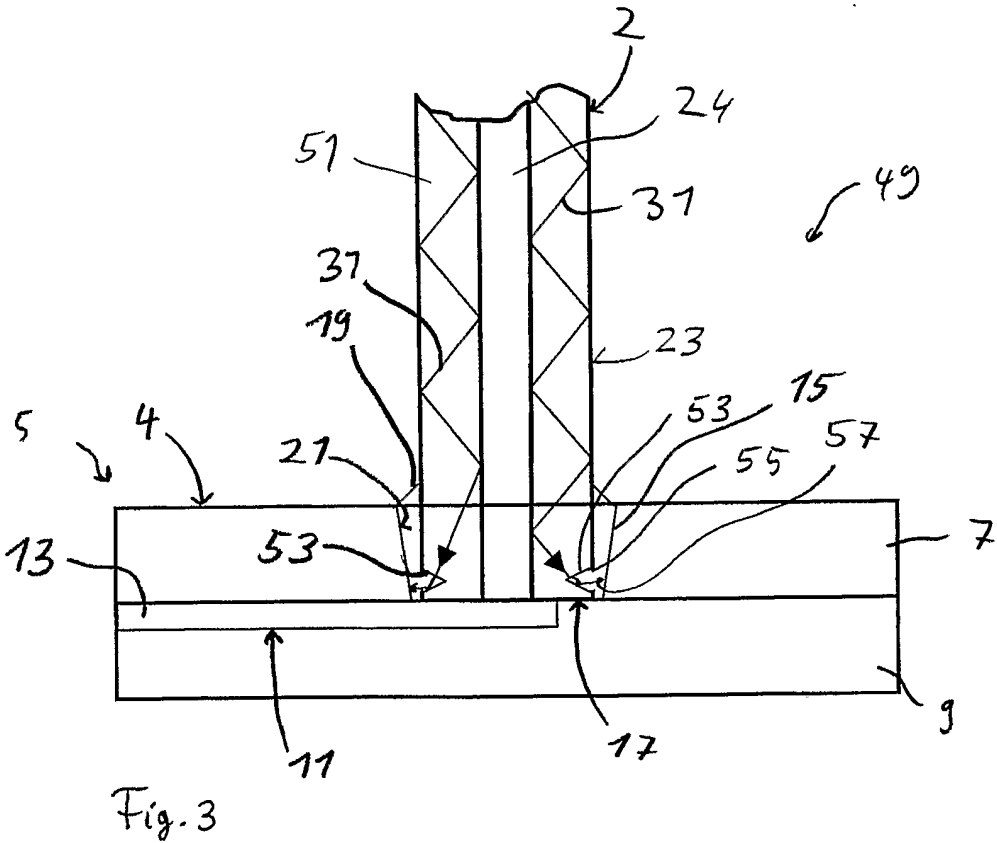
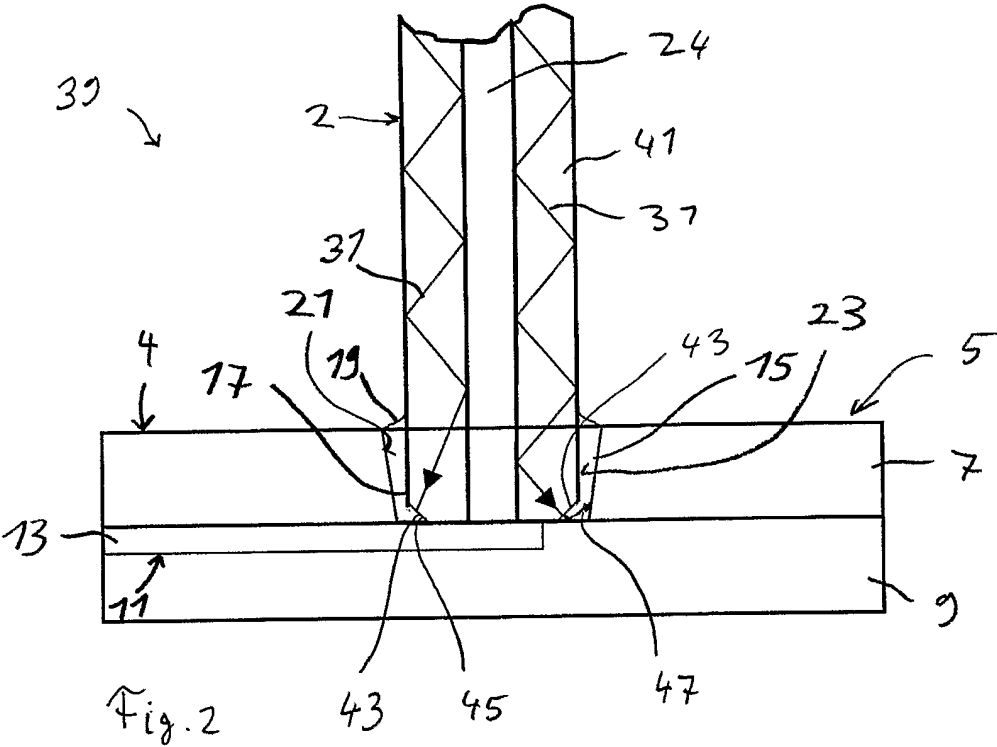


Figure 1

2/2



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/052916

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C09J5/00 B81B1/00 F15C5/00 F16L13/11

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)

IPC 7 C09J B81B F15C F16L

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 328 087 A (NELSON ET AL) 12 July 1994 (1994-07-12) example 3	1-23
X	US 6 290 791 B1 (SHAW JOHN EDWARD ANDREW ET AL) 18 September 2001 (2001-09-18) column 5 - column 6; figure 2	1-27

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *&* document member of the same patent family

Date of the actual completion of the international search

10 February 2005

Date of mailing of the international search report

21/02/2005

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/052916

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