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(54) Benævnelse: **Fremgangsmåde til at opnå en flerhed af måleområder på en chip såvel som chip med måleområder.**

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Method for producing a plurality of measurement regions on a chip, and chip comprising measurement regions

Description

The invention relates to a method for producing a plurality of measurement regions on a chip, electrically contactable electrode pairings being structured on the chip in each of the measurement regions, and the measurement regions being formed by forming a compartmental structure which separates the measurement regions from one another.

The invention furthermore relates to a chip having a plurality of electrically addressable measurement regions, a compartmental structure which separates the measurement regions from one another being provided on the chip surface.

A chip of the type mentioned at the outset, and a method for the production thereof, is known for example from US 2009/0131278 A1. The chip is a silicon-based chip, on the surface of which a plurality of electrode pairings is arranged by means of metallisation and structuring. Said pairings are arranged in a chequered manner in a two-dimensional array. The electrode arrangements consist of interlocking electrode strips that result in the two electrodes of the electrode arrangement being adjacent to one another over a significant length. The measurement regions are intended to be functionalised by specific biologically active substances. In this case, these may for example be antibodies that react chemically to specific antigens, said chemical reactions being electrically detectable by the electrode arrangement. The functionalisation is carried out by what is known as a spotting process, in which a different, for example water-based, solution is applied to each measurement region. In this case, the molecules responsible for the functionalisation are immobilised on the corresponding measurement regions. In this case, it is of essential importance that the different liquids of the individual measurement regions should not be mixed with one another, in order that just one type of relevant molecules is present on each measurement region.

In order to prevent mixing of liquids of adjacent spots, US 2009/0131278 A1 proposes providing mechanical barriers, in the form of small walls, between the individual measurement regions. The surface of the chip is thus divided, as it were, into different compartments of a box, the liquid being "poured into" one of the compartments in each case during the spotting process. It should be noted, however, that the compartments extend on the chip surface in an order of magnitude of μm. The effect of the mechanical boundaries is therefore at the limits thereof. However, owing to the surface tension of the solvent, for example water, it is possible for the liquids of adjacent measurement regions to combine and thus for the relevant functional molecules to be mixed together, despite the mechanical boundaries.

US2003194709 likewise describes a method for producing hydrophilic measurement regions on a chip.

The object of the invention is that of providing a method for producing a plurality of measurement regions on a chip, and of providing a chip that can in particular be produced by means of said method, it being possible for mixing of liquids during the spotting process to be at least substantially excluded.

The above object is achieved by a method according to independent claim 1. The dependent claims relate to advantageous developments and embodiments.

It goes without saying that designs, embodiments, advantages and the like which, in order to avoid repetitions, are set out below in relation to just one aspect of the invention, of course also apply correspondingly in relation to the remaining aspects of the invention.

Furthermore, it goes without saying that the following value, number and range specifications are not to be understood as limiting the specified values or ranges; it is obvious to a person skilled in the art that it is possible to deviate from the specified ranges and specifications, depending on the individual case or the application, without departing from the scope of the present invention.

Furthermore, all the value or parameter specifications or the like mentioned in the following can in principle be ascertained or determined using standardised or explicitly specified determination methods or using determination methods that are conventional per se for a person skilled in the art. With this proviso, the present invention will be described in greater detail in the following.

According to an aspect of the present invention the compartmental structure is preferably formed using the following process steps. Firstly, hydrophilic properties are produced in the measurement regions. This is a necessary requirement in order for the measurement regions to be able to be wetted by a hydrophilic liquid. In general, the functional molecules are dissolved in water, and therefore the hydrophilic properties of the measurement regions are of essential importance. Furthermore, the method according to the invention contains a step of producing hydrophobic wetting properties on the chip surface outside the measurement regions by applying a self-assembled monolayer consisting of a fluorosilane compound. Teflon (polytetrafluoroethylene or PTFE), for example, is possible as a fluorosilane compound. For example (tridecafluoro-1,1,2,2,-tetrahydrooctyl) trichlorosilane $C_8H_4Cl_3F_{13}Si$ can be used. The hydrophobic effect of said monolayer is advantageously far more effective than a mechanical barrier. Since it is almost impossible for the chip surface between the measurement regions to be wetted by hydrophilic liquids, a safety distance that effectively prevents mixing results between the individual spots of the functional liquids. The method according to the invention therefore advantageously allows for reliably functionalised chips to be produced.

According to another aspect of the present invention, in particular a chip is proposed, the compartmental structure being formed by a self-assembled monolayer that consists of a fluorosilane compound and that covers the chip surface outside the measurement regions.

A monolayer results when just one layer of molecules is formed on the chip surface. The self-assembly of the monolayer results from the structure of the fluorosilane compound used. The fluorosilane molecules comprise a trichlorosilane group that has a very close affinity to silicon, and therefore said group is positioned on the surface of the chip. The residue of the molecule then protrudes from the surface and forms a surface that is comparatively hydrophobic. Said hydrophobisation of the surface is advantageously very effective.

According to an embodiment of the method according to the invention, said method is carried out using the following process steps in the specified sequence in order to form the compartmental structure. Firstly, a fluorosilane compound is vapour-deposited on the chip surface as a monolayer. This is carried out in a vacuum atmosphere. CVD or PVD methods may be used. Subsequently, a photostructurable layer is applied to the chip surface. Said layer initially covers the entire chip surface. Subsequently, the measurement region is exposed using a suitable mask. The development of the photostructurable layer results in a photostructured layer, it being possible for the measurement regions to be freed. Hydrophilic properties are produced in the measurement regions thus freed, in order that the aqueous solutions can be spotted thereon. Lastly, the photostructurable layer is removed.

According to an alternative embodiment of the invention, the method for forming the compartmental structure can also be carried out using the following process steps in the specified sequence. Firstly, the hydrophilic properties are produced on the entire chip surface. Subsequently, a photostructurable layer is applied to the chip surface. Said layer can be photostructured by exposing the chip surface outside the measurement regions. A photostructured layer thus results by developing the photostructurable layer, the measurement regions being covered by the photostructured layer. Subsequently, a fluorosilane compound is vapour-deposited on the chip surface as a monolayer, and specifically in the manner already set out above. Lastly, the photostructurable layer is removed.

The significant advantage of the two alternative method sequences is that the individual manufacturing steps are well-known per se and can therefore be carried out with a high degree of process reliability. Increasing the process reliability therefore advantageously achieves qualitatively high-quality results.

According to a further embodiment of the method, the production of the hydrophilic properties is carried out in an oxygen plasma or by dry etching. These methods, which are conventional in processing of wafers, can likewise advantageously be implemented with a high degree of process reliability.

According to a further embodiment of the invention, when the method steps as have already been described above have been completed, the processed chip surface is cleaned. In this way, the chip surface can be prepared for a retrospective spotting process. Contaminants are advantageously removed, such that no measurement errors arise after spotting on account of an impure surface of the measurement regions. Cleaning of the processed chip surface may constitute the conclusion of the preparation of the chip. Said chips are subsequently packed in such a way that it is not necessary to clean the chip surface again. The user then removes the packaging only shortly before the spotting process is carried out. Alternatively, it is of course also possible for the cleaning to be carried out by the user as temporally close as possible before the spotting process.

The cleaning is preferably carried out by a wet-chemical method. It is expedient to use a piranha solution in this case. Said solution consists of a mixture of hydrogen peroxide and sulphuric acid, and is a very effective compound for cleaning the surface. The monolayer of fluorosilane compounds is advantageously chemically stable enough to withstand this cleaning step.

According to a further embodiment of the invention, it is also possible for the functionalisation of the measurement regions to be immediately carried out with a spotting process after the cleaning has been completed. In this case, the user is provided with the already functionalised chip. This is advantageous in the case of analysis methods that are very often used as standard, since the chips can be functionalised in large numbers immediately after the production thereof. In this way, the method can reliably exclude the presence of impurities.

According to a further aspect of the present invention, a method for producing a chip having a plurality of electrically addressable measurement regions or for producing a plurality of measurement regions on a chip is proposed, electrically contactable electrode pairings being structured on the chip in each of the measurement regions, and the measurement regions being formed by forming a compartmental structure which separates the measurement regions from one another.

In this case, the formation of the compartmental structure comprises producing hydrophobic wetting properties on the chip surface outside the measurement regions. Furthermore, the formation of the compartmental structure can comprise producing hydrophilic properties in the measurement regions.

Moreover, according to an aspect of the present invention that can be implemented independently, it is possible for the measurement regions to be provided with a protective layer at least substantially until the chip is installed in an electrical component. In this case, the specification "until the chip is installed" is to be understood to mean every process step in the production of the chip during which it is expedient to remove the protective layer. This may be immediately before the spotting process, but for example may also be immediately after dividing the wafer from which the chip is manufactured, or after the (divided) chips have been electrically contacted (bonded).

Using a protective layer that at least substantially covers the measurement regions allows for simplified further processing of the chip. Said chip, or the wafer from which the chip is manufactured, can for example be divided or electrically connected or provided with external passivation or moulded, without the risk of the sensitive measurement regions or surfaces of the chip vaporised with metals, such as gold, being exposed to mechanical, thermal or chemical stresses and being damaged or even destroyed.

In this case, within the context of the present invention particularly good results are achieved when the protective layer is a photostructured layer or a photoresist. Photostructured layers can in general be obtained from photostructurable layers. Within the context of the present invention, a photostructurable layer is intended to be understood in particular as a layer, the aggregation state and/or chemical state of which changes under the action of electromagnetic radiation, in particular UV radiation, resulting in a photostructured layer. It is in particular intended in this connection for only those regions of the photostructurable layer that are exposed to the electromagnetic radiation to undergo a change. The change in the protective layer brought about by the action of electromagnetic radiation may in particular be such that the layer becomes solid or liquefies, chemically hardens, i.e. becomes cross-linked, or that polymeric structures are destroyed. Using masks and for example UV emitters thus makes it possible to produce structures on the chip surface.

In this connection, it is possible that the photostructured layer may contain a photoresist or be a photoresist. Photoresists, which generally harden under the action of UV radiation, are known per se to a person skilled in the art and are commercially available in large quantities.

Within the context of the present invention, it is preferable for the photostructured layer to be a photoresist which is also used within the context of the hydrophobisation of the chip surface. In this way, time, material and outlay for equipment can be saved within the context of the present invention, since the photostructured layer applied within the context of the hydrophobisation, in particular the photoresist, remains on the measurement regions, in order to protect the measurement regions, even after hydrophobisation has been completed, and continues to protect said regions until installation or until completion of processing of the chip.

If a photostructured layer is used as the protective layer within the context of the present invention, it is thus preferable for the photostructured layer, in particular the photoresist, to be at least temporarily chemically and/or physically stable at temperatures of up to 150°C, in particular 200°C, preferably 250°C, more preferably 300°C. When processing the chip, for example during division or installation in devices, it is possible that the chip may be repeatedly exposed to thermal peaks, i.e. temporary thermal stresses. In this case, the photostructured layer or the photoresist should not chemically decompose and nor should the chemical or physical state change such that the measurement regions are no longer sufficiently protected or that the layer can no longer be removed at a later point in time.

For this reason, the protective layer or the photostructured layer that is applied should be sufficiently thermally stable, in particular at the temperature peaks that temporarily arise during chip processing.

Within the context of the present invention, thermally resistant photostructured layers or photoresists of this kind are advantageously polyamide-based. Polyamide-based photoresists often have an exceptionally high degree of thermal stability of up to 400°C and can furthermore be designed so as to be hydrophobic.

In general, the hydrophobisation is carried out within the context of the present invention by means of applying a hydrophobic layer to the chip. In this connection, it is possible for the hydrophobic layer to be applied to the chip in the form of a coating layer or a monolayer. If the hydrophobic layer is applied as a coating layer, this may in particular be photostructured layers, in particular photoresists, which harden, depolymerise or are destroyed by means of electromagnetic radiation, in particular UV radiation. If, within the context of the present invention, the hydrophobic layer is formed by a photoresist, in particular if the photoresist is applied to the chip by means of one of the methods described above, further hydrophobisation of the chip surface is usually not necessary. In this case, the hydrophobic photoresist remains outside the measurement regions on the chip and is not removed again. If, in contrast, the hydrophobic layer is formed by a monolayer, it has been found to be expedient within the context of the present invention for the monolayer to be applied as a self-assembled monolayer. Monolayers make it possible for particularly sharply defined hydrophobic regions to be created on the chip.

Equally, it is also possible, within the context of the present invention, for the hydrophobisation to be carried out by means of reaction with reactive chemical compounds. The reactive chemical compounds used within the context of the present invention are preferably silanes, in particular alkylsilanes and/or fluorosilanes. If alkylsilanes are used within the context of the present invention, it has been found to be expedient for trialkylsilanes or silazanes, preferably trimethylchlorosilane and/or hexamethyldisilazane, to be used as the alkylsilanes. If, in contrast, fluorosilanes are used within the context of the present invention, it has been found to be expedient for partially fluorinated or perfluorinated silanes, particularly preferably tridecafluoro-1,1,2,2-tetrahydrooctyl trichlorosilane, to be used.

In this case, the use of fluorosilanes is particularly preferred because these have excellent hydrophobic properties as well as excellent chemical stability.

For further details regarding the method according to the invention, reference is made to the above explanations regarding the remaining aspects of the invention, which explanations apply correspondingly with respect to the method according to the invention.

With regard to further details regarding the method according to the invention, reference is made to the explanations regarding the remaining aspects of the invention, which explanations apply correspondingly with respect to the method according to the invention.

Finally, according to a fourth aspect of the present invention, the present invention also relates to a chip having a plurality of measurement regions which can be obtained according to the methods described above.

For further details regarding the chip according to the invention, reference is made to the above explanations regarding the remaining aspects of the invention, which explanations apply correspondingly with respect to the chip according to the invention.

Further details of the invention will be described in the following with reference to the drawings. The same or corresponding elements in the drawings are in each case provided with the same reference signs in the figures, and are explained repeatedly only insofar as they differ in the individual figures. In the drawings:

Figs. 1 to 4 show selected process steps of a first embodiment of the method according to the invention,

Figs. 5 to 7 show selected manufacturing steps of another embodiment of the method according to the invention,

Fig. 8 shows a three-dimensional detail of the chip surface of an embodiment of the chip according to the invention, and

Fig. 9 is a schematic view of the chip when connected and installed.

Figure 1 shows a detail of a chip 11 made of silicon. However, the chip 11 can also consist of a different material.

The chip 11 particularly preferably comprises or contains electronic circuits and/or electrode arrangements 23 which are not shown in Fig. 1 (cf. Figs. 8 and 9).

The chip 1 preferably comprises a hydrophobic layer 12 which may be formed as a monolayer and/or can preferably contain or be formed of a fluorosilane compound.

Firstly, a fluorosilane compound, in particular as already described above, is vapour-deposited on the chip 11 in a desiccator, the fluorosilane compound forming a self-assembled monolayer 12 on the chip surface 13. Subsequently, a photostructurable layer 14 is applied to the monolayer 12. The regions that are intended to form the subsequent measurement regions 16 (cf. also Fig. 4) are exposed to light 17 using a shadow mask 15.

Figure 2 shows the photostructured layer 18 after the photostructurable layer 14 has been developed. As a result, the hydrophilic regions are defined which produce the subsequent measurement regions 16. Said regions appear as windows 19 in the photostructured layer 18.

Figure 3 shows how the hydrophilic regions were produced in oxygen plasma. The monolayer 12 has been removed, in the region of the window 19, as far as the chip surface 13. This results in the hydrophilic measurement regions 16. Subsequently, the photostructured layer 18 must also be removed from the monolayer 12. This can be seen in Fig. 4. Figure 4 also shows how different liquids 20a, 20b are applied to the measurement regions 16 in order to functionalise said measurement regions (spotting process). This results in the fully functionalised chip 11.

The method according to Figs. 5 to 7 also operates using a photostructurable layer 14 and a hydrophobic layer or a monolayer 12 (cf. Fig. 6). However, the sequence of the application of these two layers is exactly reversed compared with the method described according to Figs. 1 to 4. According to Fig. 5, the photostructurable layer 14 is first applied to the surface 13 of the chip 11.

In order to structure the photostructurable layer 14, an exposure mask 21 is preferably used, which mask consists of a transparent pane and has a light-tight coating 22 in the region of the subsequent measurement regions 16. The light 17 structures the photostructurable layer 14.

As can be seen in Fig. 6, the photostructured layer 18 remains in the measurement regions 16, while the surrounding regions are freed up to the chip surface 13. Said regions are then coated with the hydrophobic layer or self-assembled monolayer 12 which consists in particular of fluorosilanes.

As can be seen in Fig. 7, the photostructured layer 18 is subsequently removed, the measurement regions 16 being freed. Said regions are located directly on the chip surface 13. As already described, the functionalisation of the measurement regions 16 is carried out by means of a spotting process in which the liquids 20a, 20b are applied.

Alternatively, it is also possible for the measurement regions 16 to be freed only later. The measurement regions 16 are then protected by the photostructurable layer 14 or the photostructured layer 18, i.e. by a protective layer or by a photoresist or the like that forms said layer, for example until the chip 11 is separated from other chips (not shown) of a wafer or the like and/or until the chip 11 is electrically connected (bonded) and/or provided with an external passivation layer and/or moulded or installed in a housing.

In order to form the photostructurable layer 14 a photoresist is particularly preferably used. Particularly preferably a polyamide-based photoresist is used, in particular on account of the thermal stability thereof.

According to a further alternative, the structurable or structured layer 14, 18 or the photoresist is preferably used in place of the monolayer 12 or fluorosilane compound in order to form the hydrophobic layer 12 or the compartmental structure 24. As indicated in Fig. 5, the photostructurable layer 14 then forms the hydrophobic layer or coating, and thus the compartmental structure 24 or intermediate regions 27, in the desired regions. The method is simpler insofar as, since preferably only the layer 14 or the photoresist now has to be removed in order to form the measurement regions 16, the application of a second layer is also dispensed with. In this case, the photoresist is then preferably designed so as to be correspondingly hydrophobic or, according to a further alternative, can be hydrophobised.

Figure 8 shows a detail of the edge of a measurement region 16 on the chip surface 13. The measurement region 16 comprises an electrode pairing or arrangement 23 which preferably consists of a first electrode 23a and a second electrode 23b. Said electrodes preferably comprise fingers that are in particular interlocked. Said electrode arrangement 23 reacts in a very sensitive manner to functional molecules (not shown in greater detail) that are immobilised in the measurement region 16 reacting with molecules to be detected.

The measurement region 16 is furthermore surrounded by a compartmental structure 24, only a detail of which is shown. A portion of this detail is enlarged, it being possible to identify that the compartmental structure 24 is preferably formed of the layer or monolayer 12. Said layer consists in particular of molecules of the fluorosilane compound, said molecules being attached to the surface 13 of the chip 11 by means of their functional group 25, while the molecule residue 26 that produces the strongly hydrophobic properties of the monolayer 12 protrudes upwards or away from said surface.

The compartmental structure 24 or the hydrophobic layer 12 preferably forms, in particular on the free surface thereof, a hydrophobic intermediate region 27 between the (adjacent) measurement regions 16, such that liquids 20a, 20b (not shown in Fig. 8) do not flow into adjacent measurement regions 16 or do not mix or fluidically connect with adjacent liquids during spotting, i.e. the application of drops of liquid to the measurement regions 16, in particular in order to immobilise capture molecules or the like (not shown).

The compartmental structure 24 or hydrophobic layer 12 or the relevant intermediate region 27 is therefore preferably hydrophobic, in particular strongly hydrophobic.

The contact angle between the compartmental structure 24 or the hydrophobic layer 12 or the intermediate regions 27 and water is particularly preferably at least substantially 90°, preferably more than 120°, very particularly preferably more than 150°, measured in each case under normal conditions and using distilled water.

Figure 9 is a highly schematic plan view of the proposed chip 11 when connected and installed, or the chip 11 comprising or in a housing 28.

The chip 11 is preferably produced, together with other chips 11, in a conventional method, for example using CMOS technology, on a common carrier or substrate, in particular what is known as a wafer. The chips 11 are subsequently separated from one another, electrically connected, and preferably installed, in particular in an associated housing 28 or the like.

In the example shown, the chip 11 is preferably electrically connected to contact surfaces or terminals 29, in particular by means of electrical connections 30 which are shown by dashed lines. This is shown only schematically in this case. The electrical connection of the chip 11 is usually referred to as bonding.

When installed, at least the measurement regions 16 for receiving samples to be measured (not shown) are accessible.

Figure 9 shows the compartmental structure 24, the intermediate regions 27 or hydrophobic layers 12 of which (completely) surround the measurement regions 16 and/or separate said regions from one another. In particular, a grid-like or honeycombed structure is formed, each measurement region 16 preferably being surrounded in an annular manner.

As already mentioned, the measurement regions 16 may be covered or protected by a protective layer, in particular a layer 14, particularly preferably consisting of a photoresist. Said protective layer is then preferably removed only after the division of the 11 and/or after the electrical connection and/or installation of the relevant chip 11. However, it is also possible to free the measurement regions 16 earlier.

If the protective layer is removed only after installation, the protective layer is particularly preferably designed so as to be sufficiently thermally stable. Specifically, the chip 11 is in particular moulded during installation. Owing to the temperatures occurring in this case, a conventional photoresist may harden. This would make subsequent removal in the measurement regions 16 at least more difficult, or even impossible. Accordingly, a photoresist is preferably used which is sufficiently thermally stable but does not harden. A polyamide-based photoresist is in particular suitable for this purpose.

Figure 9 schematically shows an electrode arrangement 23 in just one measurement region 16, specifically in the bottom right-hand measurement region 16. Preferably identical or similar electrode arrangements 23 of this kind are in particular formed or arranged in all the measurement regions 16.

The electrode arrangements 23 are preferably formed before the compartmental structure 24 is produced or applied.

The electrode arrangements 23 are preferably located at least substantially in the chip surface 13 on which the measurement regions 16 are formed and the compartmental structure 24 is constructed.

The chip surface 13 is preferably at least substantially planar and/or is preferably a flat face of the chip 11.

In the example shown, the hydrophobic layers 12 or intermediate regions 27 are preferably linked together and/or form a coherent grid. However, they may also form separate regions or portions on the chip surface 13 which each surround or enclose one or more measurement regions 16.

Various molecules to be detected can preferably be detected in the measurement regions 16 by means of the electrode arrangements 23. Corresponding detection signals are in particular electrically emitted from the chip 11 or can preferably be retrieved electrically.

The compartmental structure 24 is preferably raised relative to the at least substantially planar chip surface 13.

The compartmental structure 24 preferably completely or annularly surrounds each measurement region 16 with the hydrophobic layer 12 or the hydrophobic intermediate region 27.

The compartmental structure 24 or hydrophobic layer 12 or monolayer or the intermediate region 27 is in particular formed in a grid-like or honeycombed manner.

The compartmental structure 24 or hydrophobic layer 12 or intermediate region 27 is preferably formed as an areal and/or planar coating.

The height of the compartmental structure 24 or hydrophobic layer 12 or the intermediate region 27 is preferably less than the width thereof. The width between two adjacent measurement regions 16 is particularly preferably larger than the height relative to the chip surface 13 carrying the measurement regions 16 at least by a factor of 5, preferably at least by a factor of 10.

The height of the compartmental structure 24 or hydrophobic layer 12 or of the hydrophobic intermediate region 27 is particularly preferably less than 2 µm, in particular less than 1 µm, and/or more than 10 nm, in particular more than 100 nm.

The intermediate regions 27 particularly preferably have a width between the measurement regions 16 of more than 10%, particularly more than 20%, particularly preferably approximately 50% or more, of a measurement region 16.

The intermediate regions 27 particularly preferably have a width between the measurement regions 16 of more than 5 µm, particularly more than 10 µm or 20 µm, particularly preferably more than 50 µm.

The measurement regions 16 preferably have a width or an average diameter of more than 50 µm, in particular more than 100 µm, and/or of less than 500 µm, preferably less than 300 µm, in particular less than 200 µm, very particularly preferably from approximately 120 to 180 µm.

During the spotting, liquid drops 20a, 20b are preferably dispensed onto the individual measurement regions 16 in particular in a volume of 1,000 to 2,000 pL in each case, the hydrophobic layers 12 or intermediate regions 27 ensuring that the liquid drops 20a, 20b remain localised on the relevant measurement region 16 or do not mix with adjacent liquid drops 20a, 20b and/or do not flow into an adjacent measurement region 16.

The spotting mentioned can in principle be carried out as desired before or after the division of the chips 11 and/or the electrical connection and installation of the relevant chip 11. The spotting is preferably carried out after the connection and installation of the chip 11.

The spotting or application of liquid drops 20a, 20b is intended in particular only for the functionalisation of the individual measurement regions 16, i.e. in particular for the deposition or bonding of specific molecules in order to capture or react with molecules to be detected in a sample. The liquid drops are in particular removed again once desired immobilisation or bonding of the specific molecules has occurred. The spotting is therefore intended in particular for preparing the chip 11 or the measurement regions 16.

The sample liquid itself, comprising molecules to be detected, is later deposited on the chip 11 or the measurement regions 16, for example over the entire surface thereof and/or using a membrane that covers the measurement regions 16 with the sample liquid located thereon in as planar a manner as possible, when the chip 11 is used as intended. In this case, the membrane may interact with the compartmental structure 24, in particular rest thereon, in order to distribute the sample liquid over the measurement regions 16 and/or to achieve fluidic separation between the sample liquid in the different measurement regions 16.

However, it is alternatively also possible to use the spotting process in order to apply one or more samples to be measured to the already functionalised measurement regions 16.

Individual aspects and features of the various embodiments, variants and alternatives may also be implemented independently from one another, but also in any desired combination.

List of reference signs

11	chip
12	monolayer
13	chip surface
14	photostructurable layer
15	shadow mask
16	measurement region
17	light
18	photostructured layer
19	window
20a, b	liquid
21	exposure mask
22	light-tight coating
23	electrode arrangement
23a, b	electrode
24	compartmental structure
25	functional group
26	molecule residue
27	intermediate region
28	housing
29	terminal
30	electrical connection

P A T E N T K R A V

1. Fremgangsmåde til fremstilling af en chip (11) med en flerhed af måleområder (16), som kan adresseres elektrisk, eller til at opnå en flerhed af måleområder (16) på en chip (11), hvor der på chippen (11) i hvert af måleområderne (16) er struktureret elektrodeparringer (23a, 23b), som kan kontaktes elektrisk, og hvor måleområderne (16) udformes ved udformning af en kammer-struktur (24), der adskiller måleområderne (16) fra hinanden, hvor udformningen af kammer-strukturen (24) omfatter de følgende fremgangsmådetrin:

at opnå hydrofobe befugtningsegenskaber på chipoverfladen (13) udenfor måleområderne (16) ved anbringelse af et hydrofobt lag (12) på chipoverfladen (13), hvor det hydrofobe lag (12) anbringes på chipoverfladen (13) i form af et lag af en hydrofob fotolak, hvor fotolakken er en polyamidbaseret fotolak, og

at opnå hydrofile egenskaber i måleområderne (16), hvor opnåelsen af hydrofile egenskaber foretages i et iltplasma eller ved hjælp af tørætsning.

2. Fremgangsmåde ifølge krav 1, k e n d e t e g n e t ved, at måleområderne (16) i det mindste i det væsentlige forsynes eller dækkes eller er forsynet eller dækket med et beskyttelseslag indtil separation eller indbygning af chippen (11).

3. Fremgangsmåde ifølge krav 1 eller 2, k e n d e t e g n e t ved, at der efter afslutning af fremgangsmådetrinene ifølge ét af de foregående krav følger en rengøring af den processerede chipoverflade (13) eller måleområderne (16).

4. Fremgangsmåde ifølge krav 3, k e n d e t e g n e t ved, at rengøringen følger ad vådkemiske veje, navnlig under anvendelse af en piranha-opløsning.

5. Fremgangsmåde ifølge krav 3 eller 4, k e n d e t e g n e t ved, at efter endt rengøring følger funktionaliseringen af måleområderne (16) med en spotting-fremgangsmåde.

6. Fremgangsmåde ifølge ét af de foregående krav, k e n d e t e g n e t ved, at de hydrofobiske mellemområder (27) omfatter en bredde mellem måleområderne (16) på mere end 10 %, navnlig mere end 20 %, af et måleområde (16).

FIG 1

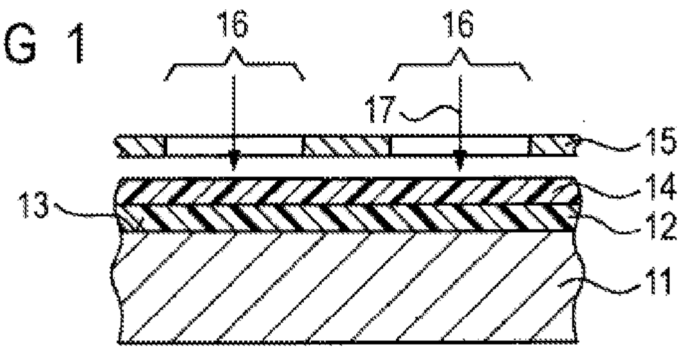

FIG 2

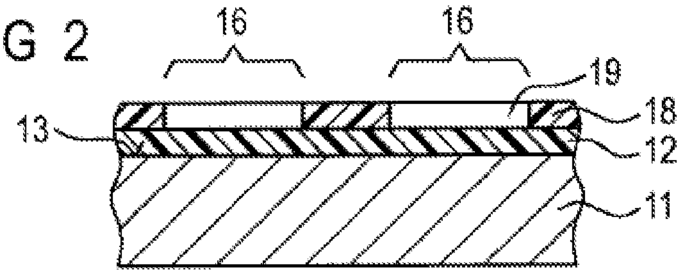

FIG 3

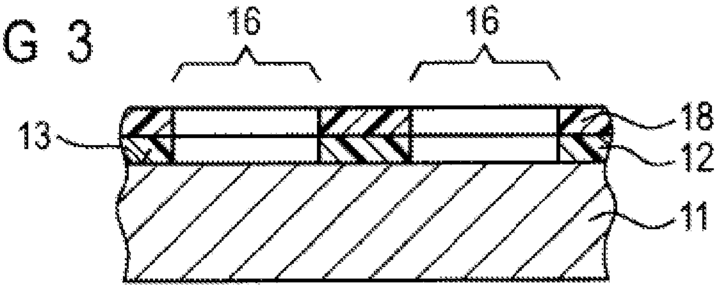

FIG 4

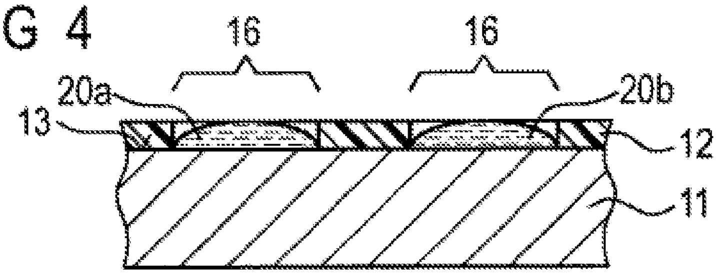

FIG 5

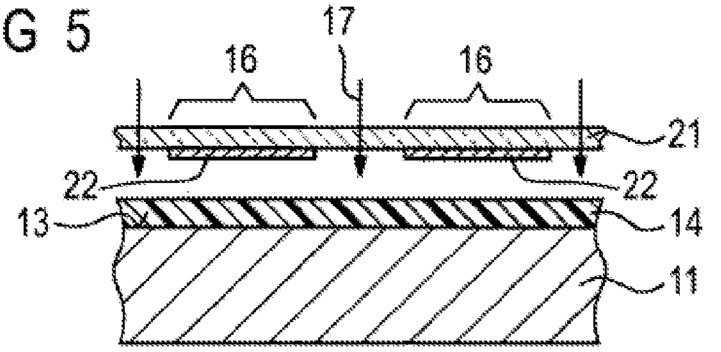

FIG 6

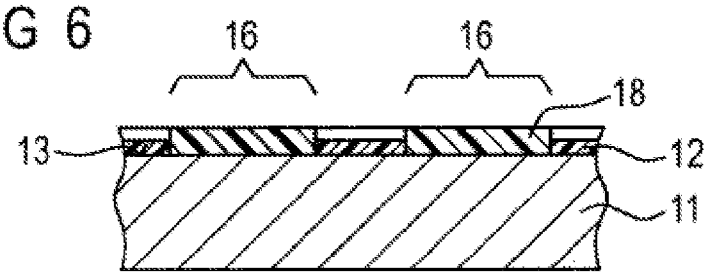

FIG 7

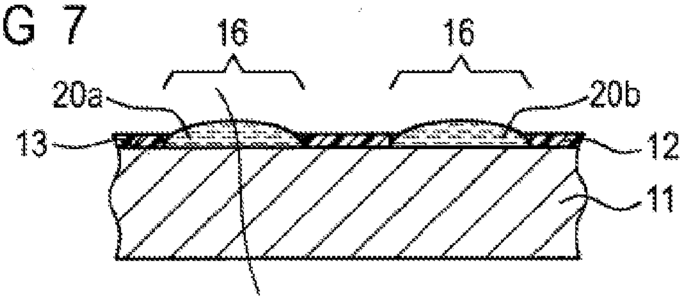

FIG 8

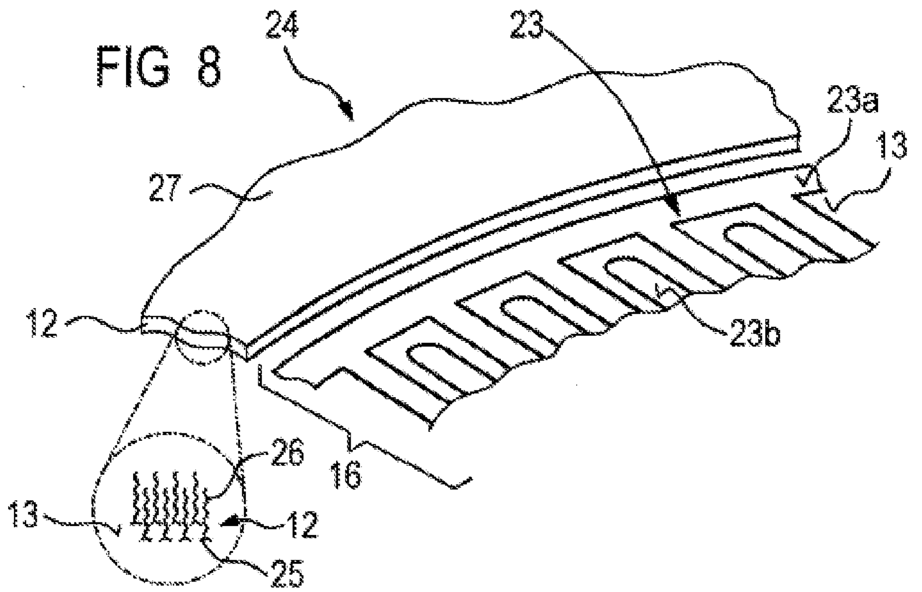

FIG 9