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(54) **FILLING OF A PRINTING CHAMBER AND A CHUCK THEREFORE**

BEFÜLLUNG EINER DRUCKKAMMER UND SPANNFUTTER DAFÜR

REPLISSAGE D'UNE CHAMBRE D'IMPRESSION ET SUPPORT DE TRANCHE ASSOCIÉ

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Description

Field of the Invention

[0001] This invention pertains in general to the field of electrochemical pattern replication. More particularly the invention relates to a method for filling an ECPR chamber, and a chuck adapted therefore.

Background of the Invention

[0002] Electroplating/electroetching is used for microelectronics in a wide range of applications, such as interconnects, components, waveguides, inductors, contact pads etc.

[0003] In the field of microelectronics electroplating/electroetching is suitable for applications involving production of micro and nano structures in single or multiple layers, fabrication of PWB (printed wiring boards), PCB (printed circuit boards), MEMS (micro electro mechanical systems), IC (integrated circuit) interconnects, above IC interconnects, sensors, flat panel displays, magnetic and optical storage devices, solar cells and other electronic devices. It can also be used for different types of structures in conductive polymers, structures in semiconductors, structures in metals, and others. Even 3D-structures in silicon, such as by formation of porous silicon, are possible.

[0004] Chemical vapour deposition and physical vapour deposition are processes that may also be used for metallization, but electroplating/electroetching is often preferred since it is generally less expensive than other metallization processes and it can take place at ambient temperatures and at ambient pressures.

[0005] Electroplating/electroetching of a work piece takes place in a reactor containing an electrolyte. An anode, carrying the metal to be plated, is connected to a positive voltage. In some cases, the anode is inert and the metal to be plated comes from the ions in the electrolyte. The conductivity of the work piece, such as a semiconductor substrate, is generally too low to allow the structures to be plated to be connected through the substrate to backside contacts. Therefore, the structures to be plated first have to be provided with a conductive layer, such as a seed layer. Leads connect the pattern to finger contacts on the front side. The finger contacts are in turn connected to a negative voltage. The electroplating step is an electrolytic process where the metal is transferred from the anode, or from the ions in the electrolyte, to the conductive pattern (cathode) by the electrolyte and the applied electric field between the anode and the conductive layer on the work piece, which forms the cathode.

[0006] The ever-increasing demand for smaller, faster and less expensive microelectronic and micro-electromechanical systems requires corresponding development of efficient and suitable manufacturing techniques, which has resulted in the development of electrochemical pattern replication (ECPR).

[0007] In ECPR plating/etching cells or cavities are formed between a master electrode and the substrate, said cavities being defined by a conductive surface on the master electrode, an insulating material, defining the pattern to be plated/etched, and the conductive surface of the substrate. During plating, a predeposited anode material has been arranged, normally through electrochemical plating, in the cavities. The master electrode and the substrate are put in close contact with each other in the presence of an electrolyte, suitable for the intended purpose, such that the electrolyte is "trapped" in the ECPR plating/etching cavities. WO 02/103085, to the present inventors, describes a system of this kind.

[0008] EP500513 describes a method of filling a chamber for electroplating CDs in which the electrolyte is injected through inlets around the peripheral wall of the chamber to flow from the edge of the CD substrate to the centre.

[0009] During an ECPR process the ECPR chamber has to be filled with electrolyte before plating in manner such that all the plating/etching cavities are filled. When introducing electrolyte into the ECPR chamber, the possibilities are somewhat reduced, due the positioning of the substrate and the master electrode, and there is a risk of entrapping gas volumes in the interspace between the master electrode and the substrate, resulting in inferior ECPR printing. Also, since complete covering of the master electrode must be assured, more electrolyte than needed is often injected into the ECPR chamber, but still there is no guarantee of filling the cavities or trenches completely, and a lot of electrolyte goes to waste.

Summary of the Invention

[0010] Accordingly, the present invention preferably seeks to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination, by providing a chuck for holding a substrate or master electrode in an ECPR process, said chuck comprising an interaction surface for holding a master electrode or a substrate; a buffer surface circumferentially of the interaction surface; wherein the interaction surface and the buffer surface extend in substantially the same plane; at least one electrolyte injection mouth arranged in the buffer surface and adjacent the interaction surface; and a method of filling an ECPR chamber, said ECPR chamber comprising a master electrode and a substrate facing each other, said method comprising injecting an electrolyte adjacent the master electrode or substrate, from one side of the master electrode or substrate to the other side of the master electrode or substrate.

[0011] Further advantageous embodiments will be apparent from the appended dependent claims.

Brief Description of the Drawings

[0012] These and other aspects, features and advantages

tages of which the invention is capable of will be apparent and elucidated from the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1 discloses a top view of a chuck for holding a master electrode or a substrate during ECPR according to one embodiment of the present invention; and ,

Fig. 2 discloses a cross section of a part of a chuck according to one embodiment of the present invention.

Description of embodiments

[0013] The following description focuses on embodiments of the present invention applicable to a method for filling an ECPR chamber during an ECPR process, and chucks and chuck assemblies therefore. However, it will be appreciated that the invention is not limited to this application but may be applied to many other replication, patterning or bonding processes within the field of micro electronics and/or mechanics where filling of a process chamber or portions thereof with a fluid is desired, including for example wafer bonding, various lithographic processes, dry or wet etching processes, etc.

[0014] During ECPR an electrolyte is injected into an ECPR chamber, preferably a sealed ECPR chamber, such that a space between a master electrode and a substrate is filled with an electrolyte. Thereafter the substrate and the master electrode are compressed, and plating/etching is performed in the cavities formed between the conductive surface of the substrate, the isolating structure on the master electrode, and the conductive surface on the master electrode.

[0015] Fig. 1 discloses a top view of a chuck 100 for holding a master electrode or a substrate during ECPR according to one embodiment of the present invention. The master electrode comprises (not shown) a conducting disc, at least one insulating layer arranged on the conducting disc, cavities in the insulating layer and/or in the conducting disc, a substantially inert electrode layer arranged in the bottom of said cavities on the conducting disc and may comprise an anode material (such as copper), dissolvable in an electrochemical process, arranged in said cavities on the electrode layer. The chuck 100 comprises a circular interaction surface 101, onto which a master electrode or a substrate is attached. The substrate or the master electrode may be held to the interaction surface by suitable holding means, such as applied vacuum in a sealed off area between the chuck 100 and the substrate or master electrode (not shown), or other mechanical holding means, such as circumferentially arranged clamps etc.

[0016] Circumferentially of the interaction surface 101 a buffer surface 102 is arranged. The buffer surface 102 act as an area/surface to collect the abundant electrolyte injected before ECPR printing and as an area/surface for

injecting electrolyte before ECPR printing. The interaction surface 101 and the buffer surface 102 extend in substantially the same plane, to accomplish the collection of abundant electrolyte while simultaneously allowing for effective (with respect to volume, direction, control, etc.) injection of electrolyte.

[0017] In the buffer surface 102 electrolyte injection mouths 103 are arranged. The injection mouths 103 may be positioned adjacent the interaction surface 101. The injection mouths 103 may be directed upwards. Also the injection mouths 103 may be directed upwards and medially. This may be accomplished by positioning fins (not shown) in the injection mouths 103, said fins slanting upwards and inwards (medially). In this way the injected electrolyte may be directed towards the interaction surface 101 and a master electrode or substrate positioned there on. Fig. 2 discloses a cross section of a part of the chuck 100, wherein the interaction surface 101, the buffer surface 102, and a cross section of a mouth 103 is disclosed.

[0018] In one embodiment, a seal is arranged on the top chuck or ECPR machine members adjacent the top chuck. The seal may be arranged on a hoisting member, said hoisting member being regulating the vertical position of the seal, such that it may be brought into contact with the bottom chuck or lifted upwards to be liberated from contact with the bottom chuck. The hoisting member may for instance comprise a pneumatic actuator. During printing the master electrode and the substrate are in contact with each other, whereby the hoisting member and the seal is in a first position with respect to the top chuck and creating a seal with an area on the bottom chuck. When separating the master electrode and substrate, by moving the top chuck and bottom chuck away from each other in vertical direction, the hoisting member and seal are moved to a second position with respect to the top chuck so that its relative vertical position to the bottom chuck is maintained, and the seal against the bottom chuck is kept.

[0019] For extra protection against leaks during filling of the ECPR chamber, said chamber may comprise a splash ring (not shown). The splash ring may be arranged circumferentially of the seal on the top chuck or ECPR machine members adjacent the top chuck. The splash ring may be arranged on a hoisting member, said hoisting member being regulating the vertical position of the splash ring, such that it may be positioned circumferentially of the seal. The hoisting member may for instance comprise a pneumatic actuator. The buffer surface 102 may be hydrophobic. The hydrophobic materials of said buffer surface 102 may be materials that act hydrophobic against electrolytes, such as hydrophobic polymeric materials, such as PTFE, or non-oxidizing metals, such as gold or platinum.

[0020] From the injection mouths 103, hydrophilic bridges (not shown) may be arranged towards the interaction surface 101. The hydrophilic bridges may be of polar dielectric materials, such as oxides of metals or

semi-conductive materials, for example titanium, or silicon dioxide, silicon nitride, or glass material having a hydrophilic behavior in the electrolyte being used.

[0021] When the materials being used for the buffer surface 102 and the bridges are inert in the electrolyte being used, oxidation may be avoided.

[0022] The injection mouths 103 are distributed such that injected electrolyte will sweep across the master electrode or substrate positioned on the interaction surface 101. For this purpose the injection mouths 103 are distributed on one side of the interaction surface only. In case of multiple injection mouths 103, the array of injection mouths 103 is distributed along a curvature adjacent to and circumventing the interaction surface, wherein the angle α between the first of the injection mouths 103 in said array to a centre point 104 of the interaction surface 101 to the last of the injection mouths in said array creates an angle 270 degrees or less. In this way, opposing flow directions of electrolyte is avoided, such opposing flows of electrolyte, risking to trap gas between the master electrode or substrate, such that a front is created that flows towards the other side of the wafer, thereby pushing out the volume of air that was previously existing between the master electrode and the substrate. By regulating the relative flow rates between several injection mouths the shape and propagation of the electrolyte filling front can be controlled, in order to deliver an optimized fill cycle with a short filling time and a fill front propagation ensuring that the volume of air that was previously existing between the master electrode and the substrate is not entrapped between the master electrode and the substrate. In one embodiment having at least three injection mouths forming an array distributed along a curvature adjacent to and circumventing the interaction surface, the flow rates are controlled such that the injection mouths oriented furthest out in the array have a lower flow rate than at least one of the other injection mouths in the array. Thus, when filling the ECPR chamber the electrolyte is injected through the mouths 103. The electrolyte may be degassed before entering the ECPR chamber through the mouths 103. The degassing of the electrolyte may be performed in an external or internal degassing system. Also, wetting agents may be added to the electrolyte before injection into the ECPR chamber. When entering the ECPR chamber, the electrolyte will build up on the buffer surface 102 in the vicinity of the mouths 103, because of the hydrophobic nature of the buffer surface 102. Then, the electrolyte will come into contact with the master electrode or substrate positioned on the interaction surface 101. When the electrolyte comes into contact with the master electrode or the substrate, the hydrophilic characteristics of master electrode or substrate will suck the electrolyte over the surface thereof. To facilitate the connection between the electrolyte and the master electrode or substrate the hydrophilic bridges may be arranged in between the interaction surface 101 and the mouths 103. Due to the arrangement of the mouths 103 along only one side of the interaction surface 101, the electrolyte

will sweep from one side of the master electrode or substrate over to the other, without meeting opposing flows of electrolyte. Thus, entrapment of gas on the master electrode or substrate may be avoided.

[0023] In one embodiment, the pressure in the ECPR chamber is lowered by applying a vacuum in the ECPR chamber before injecting the electrolyte into the ECPR chamber. In this way the volume of gas, such as air, in the ECPR chamber may be lowered, thus minimizing the risk of gas entrapment. Also, a low pressure in the ECPR chamber speeds up the movement of the electrolyte across the master electrode or substrate. Thus, a low pressure nozzle (not shown) may be in communication with the ECPR chamber. Also, a small amount of ultrasonic energy may be added to the electrolyte before, during, or after being injected into the ECPR chamber. When applying ultrasonic energy, bubbles that have been trapped in the electrolyte or on the master electrode or substrate may be removed. The ultrasonic energy may be added through the chuck surface. Also, convection may be used, by pumping electrolyte in pumping patterns through the mouths 103, for removing entrapped gas bubbles in the same manner.

[0024] In one embodiment the substrate and the master electrode are positioned close to each other, such that the capillary force of the electrolyte may be used to suck the electrolyte over the interface, thus sweeping gas away from said interface.

[0025] Adjacent the interaction surface 101 electrolyte recycling outlets 105 are arranged. The recycling outlets 105 may be evenly distributed circumferentially of the interaction surface 101. The recycling outlets 105 are distributed around the entire interaction surface, to maximize electrolyte recycling. When the electrolyte has filled the space between master electrode and the substrate, and the master electrode and the substrate have been squeezed together, the excess of electrolyte will gather along the edge of the master electrode or substrate, due to the hydrophilic nature of the master electrode or the substrate. During normal filling procedures, a majority of the injected electrolyte may be pushed out towards the circumference of the master electrode and the substrate, and can gather along the edges thereof. Then, typically before printing, the excessive amount of electrolyte can be pumped out of the ECPR chamber through the recycling outlets 105 into a recycling tank (not shown).

[0026] Since the excess of electrolyte not has been part of a printing step, this electrolyte is chemically unchanged, and can be reused. Thus, the electrolyte in the recycling tank is filtered and transported into a supply tank (not shown), from which supply tank electrolyte is injected into the ECPR chamber again, during a subsequent filling step. For manufacturability or economical reasons, the electrolyte may be alternatively transported, possibly through a filter, directly to the supply tank.

[0027] When performing the recycling step, i.e. pumping electrolyte out from the ECPR chamber through the recycling outlets 105, typically the volume just outside

the ECPR chamber may be ventilated to atmosphere, to facilitate the pumping of the electrolyte into the recycling tank.

[0028] In one embodiment the same holes are used as mouths 103 and outlets 105. In this embodiment there is a valve in the conduit leading to the holes on the buffer surface. Thus, at least one of the holes will act as inlet mouth(s) during filling of the ECPR chamber, in accordance with the criteria disclosed above. After filling and pressing the master electrode and the substrate together, valves in the conduits leading to this/these holes are switched, such that also these holes, as well as other holes arranged adjacent and circumferentially of the interaction surface 102, will act as recycling outlets.

[0029] It is readily understood that all references to lower/upper are merely for illustrative purposes, without any limiting effect on the scope of protection. Moreover, it should be realized that equivalent setups to those described may include setups having a substrate arranged on a lower chuck while the master electrode is mounted on an upper chuck, as well as setups in which the positions of the lower and upper chuck are switched.

[0030] In the claims, the term "comprises/comprising" does not exclude the presence of other elements or steps. Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented by e.g. a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly advantageously be combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. In addition, singular references do not exclude a plurality. The terms "a", "an", "first", "second" etc do not preclude a plurality. Reference signs in the claims are provided merely as a clarifying example and shall not be construed as limiting the scope of the claims in any way.

Claims

1. A chuck (100) for holding a substrate or master electrode in an ECPR process, said chuck comprising an interaction surface (101) for holding a master electrode or a substrate;
a buffer surface (102) circumferentially of the interaction surface (101);
wherein the interaction surface (101) and the buffer surface (102) extend in substantially the same plane;
characterized in that the chuck further comprises an array of at least two electrolyte injection mouths (103) arranged in the buffer surface (102), the injection mouths (103) being directed upwards and distributed on one side of the interaction surface (101), along a curvature adjacent to and circumventing the interaction surface (101), wherein an angle (α) between a first of the injection mouths (103) in said array to a centre point (104) of the interaction surface

(101) to a last one of the injection mouths (103) is 270 degrees or less.

2. The chuck according to claim 1, wherein the injection mouths (103) are directed medially towards the centre of the interaction surface (101).
3. The chuck according to any of the preceding claims, wherein the buffer surface (102) is hydrophobic.
4. The chuck according to any of the preceding claims, comprising hydrophilic bridges from the at least one injection mouth (103) towards the interaction surface (101).
5. The chuck according to any of the preceding claims, comprising electrolyte recycling outlets (105) adjacent and circumferentially of the interaction surface (101).
6. The chuck according to claim 5, wherein the recycling outlets (105) are evenly distributed circumferentially of the interaction surface (101).
7. A method of filling a printing chamber, said printing chamber comprising a first substrate and a second substrate facing each other, said method comprising injecting an electrolyte adjacent to the first substrate or the second substrate, from one side of the first substrate or second substrate to the other side of the first substrate or second substrate.
8. The method according to claim 7, wherein said first substrate is a master electrode for an ECPR printing process, and said printing chamber is an ECPR printing chamber.
9. The method according to claim 8, comprising degassing the electrolyte before entering the ECPR chamber.
10. The method according to claim 8 or 9, comprising lowering the pressure in the ECPR chamber before injecting the electrolyte into the ECPR chamber.
11. The method according to any of claims 8 to 10, comprising adding ultrasonic energy to the electrolyte before, during, or after being injected into the ECPR chamber.
12. The method according to any of claims 8 to 11, comprising adding convection to the electrolyte after injection the electrolyte into the ECPR chamber.
13. The method according to any of claims 8 to 12, positioning the substrate and the master electrode close to each other, such that the capillary force of the electrolyte may be used to suck the electrolyte

over the interface between the master electrode and the substrate.

14. The method according to any of claims 8 to 13, comprising removing excessive electrolyte from the ECPR chamber after compressing the master electrode and the substrate and recycling the removed excessive electrolyte via a recycling tank through a filter to an injection tank, from which the electrolyte again may be injected into the ECPR chamber.
15. A chuck assembly for holding a substrate or master electrode in a printing process, comprising a chuck according to any of claims 1 to 6, and an opposing chuck, wherein a splash ring and a seal are arranged circumferentially of the interaction surface (101), said splash ring and said seal are vertically movable by a first and a second hoisting member, respectively, such that that fluid is prevented from passing at least the splash ring when the master electrode and the substrate are in contact and when the master electrode and the substrate are separated.

Patentansprüche

1. Einspannvorrichtung zum Festhalten eines Substrats oder einer Masterelektrode in einem ECPR-Verfahren, umfassend
eine Interaktionsfläche (101) zum Festhalten einer Masterelektrode oder eines Substrats;
eine Pufferfläche (102) in Umfangsrichtung der Interaktionsfläche (101); wobei die Interaktionsfläche (101) und die Pufferfläche (102) sich in im Wesentlichen derselben Ebene erstrecken;
dadurch gekennzeichnet, dass die Einspannvorrichtung weiter umfasst eine Anordnung von mindestens zwei Elektrolyteinspritzmündungen (103), die in der Pufferfläche (102) angeordnet sind, wobei die Einspritzmündungen (103) aufwärts gerichtet sind und an einer Seite der Interaktionsfläche (101) verteilt sind, entlang einer Krümmung benachbart zu der Interaktionsfläche (101) und diese Interaktionsfläche umgehend, wobei ein Winkel (α) zwischen einer ersten der Einspritzmündungen (103) in der Anordnung zu einem Mittelpunkt (104) der Interaktionsfläche (101) zu einer letzten der Einspritzmündungen (103) 270 Grad oder weniger beträgt.
2. Einspannvorrichtung nach Anspruch 1, wobei die Einspritzmündungen (103) mittig zu dem Zentrum der Interaktionsfläche (101) gerichtet sind.
3. Einspannvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Pufferfläche (102) hydrophob ist.
4. Einspannvorrichtung nach einem der vorhergehenden

den Ansprüche, umfassend hydrophile Brücken von der mindestens einen Einspritzmündung (103) zu der Interaktionsfläche (101).

5. Einspannvorrichtung nach einem der vorhergehenden Ansprüche, umfassend Elektrolytrecyclingauslässe (105) benachbart zu und in Umfangsrichtung der Interaktionsfläche (101).
6. Einspannvorrichtung nach Anspruch 5, wobei die Recyclingauslässe (105) in Umfangsrichtung der Interaktionsfläche (101) gleichmäßig verteilt sind.
7. Verfahren zum Füllen einer Druckkammer, wobei die Druckkammer ein erstes Substrat und ein zweites Substrat, die einander zugewandt sind, umfasst, wobei das Verfahren das Einspritzen eines Elektrolyten benachbart zu dem ersten Substrat oder dem zweiten Substrat, von einer Seite des ersten Substrats oder zweiten Substrats zur anderen Seite des ersten Substrats oder zweiten Substrats, umfasst.
8. Verfahren nach Anspruch 7, wobei das erste Substrat eine Masterelektrode für ein ECPR-Druckverfahren ist und die Druckkammer eine ECPR-Druckkammer ist.
9. Verfahren nach Anspruch 8, das Entgasen des Elektrolyten vor dem Eintreten in die ECPR-Kammer umfassend.
10. Verfahren nach Anspruch 8 oder 9, das Senken des Drucks in der ECPR-Kammer vor dem Einspritzen des Elektrolyten in die ECPR-Kammer umfassend.
11. Verfahren nach einem der Ansprüche 8 bis 10, das Hinzufügen von Ultraschallenergie zum dem Elektrolyten vor, während oder nach dessen Einspritzen in die ECPR-Kammer umfassend.
12. Verfahren nach einem der Ansprüche 8 bis 11, das Hinzufügen von Konvektion zu dem Elektrolyten nach Einspritzen des Elektrolyten in die ECPR-Kammer umfassend.
13. Verfahren nach einem der Ansprüche 8 bis 12, Positionieren des Substrats und der Masterelektrode dicht beieinander, sodass die Kapillarkraft des Elektrolyten angewendet kann, um den Elektrolyten über die Schnittstelle zwischen der Masterelektrode und dem Substrat zu saugen.
14. Verfahren nach einem der Ansprüche 8 bis 13, das Entfernen überschüssigen Elektrolyten aus der ECPR-Kammer nach dem Komprimieren der Masterelektrode und des Substrats und Recyceln des entfernten überschüssigen Elektrolyten mittels eines Recyclingtanks durch einen Filter zu einem Ein-

spritztank, aus welchem der Elektrolyt wieder in die ECPR-Kammer eingespritzt werden kann, umfassend.

15. Einspannvorrichtungsanordnung zum Festhalten eines Substrats oder einer Masterelektrode in einem Druckverfahren, umfassend eine Einspannvorrichtung nach einem der Ansprüche 1 bis 6, und eine gegenüberliegende Einspannvorrichtung, wobei ein Spritzring und eine Dichtung in Umfangsrichtung der Interaktionsfläche (101) angeordnet sind, wobei der Spritzring und die Dichtung durch ein erstes beziehungsweise ein zweites Hebeelement vertikal bewegbar sind, sodass Fluid daran gehindert wird, mindestens den Spritzring zu passieren, wenn die Masterelektrode und das Substrat in Kontakt sind und wenn die Masterelektrode und das Substrat getrennt sind.

Revendications

1. Mandrin (100) pour maintenir un substrat ou une électrode maître dans un procédé de réplique électrochimique de motifs (EPCR), ledit mandrin comprenant :

une surface d'interaction (101) pour maintenir une électrode maître ou un substrat ;
une surface tampon (102) disposée sur la circonférence de la surface d'interaction (101) ;
dans lequel la surface d'interaction (101) et la surface tampon (102) s'étendent essentiellement dans le même plan ;
caractérisé en ce que le mandrin comprend en outre :

une série d'au moins deux orifices d'injection d'électrolyte (103) disposés dans la surface tampon (102), les orifices d'injection (103) étant orientés vers le haut et étant distribués sur un côté de la surface d'interaction (101) le long d'une courbure adjacente à la surface d'interaction 101 et entourant ladite surface, l'angle « α » formé entre un premier orifice parmi les orifices d'injection (103) dans ladite série en passant par un point central (104) de la surface d'interaction (101) jusqu'au dernier orifice parmi les orifices d'injection (103) s'élevant à 270° ou moins.

2. Mandrin selon la revendication 1, dans lequel les orifices d'injection (103) sont orientés en direction médiane vers le centre de la surface d'interaction (101).
3. Mandrin selon l'une quelconque des revendications

précédentes, dans lequel la surface tampon (102) est hydrophobe.

4. Mandrin selon l'une quelconque des revendications précédentes, comprenant des ponts hydrophiles depuis ledit au moins un orifice d'injection (103) jusqu'à la surface d'interaction (101).
5. Mandrin selon l'une quelconque des revendications précédentes, comprenant des sorties de recyclage d'électrolyte (105) en position adjacente de la surface d'interaction (101) et sur la circonférence de cette dernière.
6. Mandrin selon la revendication 1, dans lequel les sorties de recyclage d'électrolyte (105) sont distribuées de manière équidistante sur la circonférence de la surface d'interaction (101).
7. Procédé de remplissage d'une chambre d'impression, ladite chambre d'impression comprenant un premier substrat et un second substrat se faisant mutuellement face, ledit procédé comprenant le fait d'injecter un électrolyte en position adjacente au premier substrat ou au second substrat, à partir d'un côté du premier substrat ou du second substrat jusqu'à l'autre côté du premier substrat ou du second substrat.
8. Procédé selon la revendication 7, dans lequel ledit premier substrat est une électrode maître pour un procédé d'impression ECPR et ladite chambre d'impression est une chambre d'impression ECPR.
9. Procédé selon la revendication 8, comprenant le dégazage de l'électrolyte avant la pénétration de ce dernier dans la chambre ECPR.
10. Procédé selon la revendication 8 ou 9, comprenant la réduction de la pression régnant dans la chambre ECPR avant l'injection de l'électrolyte dans la chambre ECPR.
11. Procédé selon l'une quelconque des revendications 8 à 10, comprenant l'addition d'une énergie ultrasonore à l'électrolyte avant, pendant ou après l'injection de ce dernier dans la chambre ECPR.
12. Procédé selon l'une quelconque des revendications 8 à 11, comprenant l'addition d'une convection à l'électrolyte après l'injection de l'électrolyte dans la chambre ECPR.
13. Procédé selon l'une quelconque des revendications 8 à 12, comprenant le positionnement du substrat et de l'électrode maître à proximité l'un de l'autre d'une manière telle que la force capillaire de l'électrolyte peut être utilisée sur toute l'interface entre l'électrode

maître et le substrat.

14. Procédé selon l'une quelconque des revendications 8 à 12, comprenant l'élimination de l'électrolyte en excès à partir de la chambre ECPR après la compression de l'électrode maître et du substrat et le recyclage de l'électrolyte en excès éliminé, via un réservoir de recyclage à travers un filtre en direction d'un réservoir d'injection à partir duquel l'électrolyte peut à nouveau être injecté dans la chambre ECPR. 5 10
15. Assemblage de mandrins pour maintenir un substrat ou une électrode maître dans un procédé d'impression, comprenant un mandrin selon l'une quelconque des revendications 1 à 6 et un mandrin opposé, dans lequel un anneau de dégraissage et un joint d'étanchéité sont disposés sur la circonférence de la surface d'interaction (101), ledit anneau de dégraissage et ledit joint d'étanchéité étant mobiles en direction verticale via un premier et un deuxième élément de levage, respectivement, d'une manière telle que l'on empêche le passage d'un fluide à travers au moins l'anneau de dégraissage lorsque l'électrode maître et le substrat sont mis en contact et lorsque l'électrode maître et le substrat sont séparés. 15 20 25

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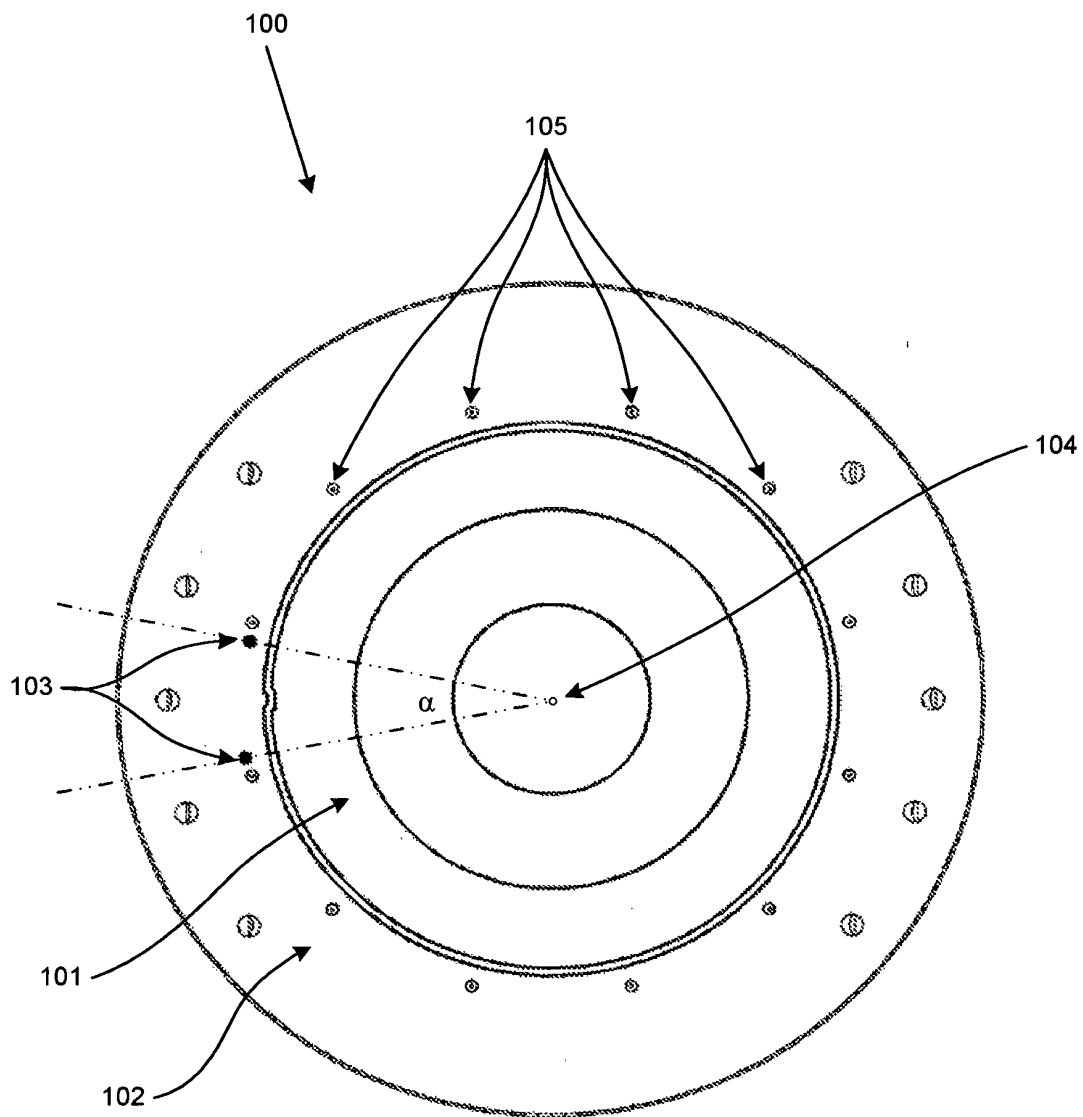


Fig. 1

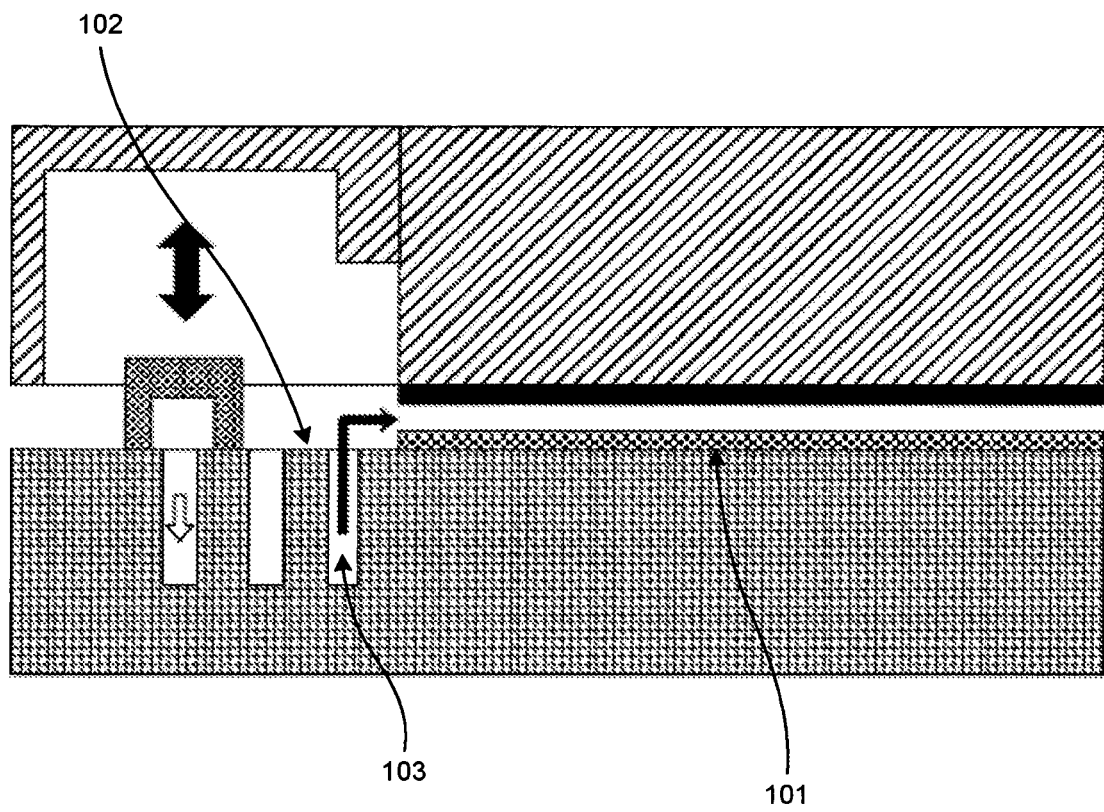


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 02103085 A [0007]
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