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(54) **GUIDEWIRE SYSTEM AND METHOD FOR MANUFACTURING A GUIDEWIRE SYSTEM**

FÜHRUNGSDRAHTSYSTEM UND VERFAHREN ZUR HERSTELLUNG EINES FÜHRUNGSDRAHTSYSTEMS

SYSTÈME DE FIL-GUIDE ET MÉTHODE DE FABRICATION DU SYSTÈME DE FIL-GUIDE

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EP 3 254 610 B1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a guidewire system, a measuring system, and a method for manufacturing such guidewire system.

BACKGROUND OF THE INVENTION

[0002] WO 03/030752 A1 discloses catheter lesion diagnostics. A diagnostic apparatus includes an expandable catheter comprising a catheter body having an expandable portion. The expandable portion includes a plurality of spaced piezoelectric elements and a controller that controllably produces and receives a signal from elements of said plurality of spaced piezoelectric elements. EP 1 837 638 A1 discloses a pressure sensor mounted at the distal end of an insertion means for intravascular measurements of pressure in a living body.

[0003] Catheters and guidewires represent the hands of a physician inside a patient body and in particular inside the human vasculature. The haptic feel of the guidewire is therefore most important to e.g. safely reach a predetermined location in the body for a predetermined treatment of the patient. However, this haptic feel may be deteriorated by the use of sensor elements. As a result, the haptic feels of guidewires with sensor elements needs to be re-improved.

SUMMARY OF THE INVENTION

[0004] Hence, there may be a need to provide an improved guidewire system with enhanced handiness.

[0005] The problem of the present invention is solved by the subject-matters of the independent claims, wherein further embodiments are incorporated in the dependent claims. It should be noted that the aspects of the invention described in the following apply also to the guidewire system, the measuring system, and the method for manufacturing such guidewire system.

[0006] According to the present invention, a guidewire system is presented. The guidewire system comprises a guidewire and a surface acoustic wave sensor device. A portion of a surface of the guidewire is coated by the surface acoustic wave sensor device. The surface acoustic wave sensor device comprises a piezoelectric substrate and a transducer. A thickness of the surface acoustic wave sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 50 μm.

[0007] The guidewire system according to the invention allows integrating a sensor device in a guidewire without changing the haptic feel of the guidewire. This may be achieved by using a surface acoustic wave sensor device as sensor device, by installing the sensor device by coating and/or by applying the sensor device with a very minor thickness.

[0008] The thereby constant and unamended haptic feel and the improved handiness can be used, for example, to locate and/or classify a stenosis or another disease state within arteries and/or veins. The haptic feel may also be used to determine a location for an implantable device within the vasculature, such as a stent, a heart valve or the like.

[0009] The wording "surface acoustic wave sensor device" will be abbreviated in the following as SAW sensor device or sensor device. In an example, the sensor device is configured for measuring a pressure change. In an example, the sensor device is configured for measuring a pressure change in front and after a vasoconstriction to e.g. perfectly position a stent. The sensor device may be a passive sensor with wireless data and energy transfer. The sensor device may be arranged anywhere on the guidewire and, for example, directly at a distal end of the guidewire.

[0010] The guidewire system may comprise several surface acoustic wave sensor devices distributed on or along the guidewire to precisely locate an e.g. seizure of the vein and therefore to perfectly position a stent. Further, several sensor devices allow a 3D visualization of the measured data and in particular of the 3D pressure information.

[0011] The surface acoustic wave sensor device comprises a piezoelectric substrate and a transducer.

[0012] In an example, the piezoelectric substrate is made of zinc oxide, aluminum nitride, silicon dioxide, barium titanate, lead zirconate titanate, sodium potassium niobat, lithium niobat and/or the like. In an example, the transducer is an interdigital transducer (IDT). The IDT may comprise printed electrical paths (e.g. gold thin-film) provided on a piezoelectric substrate (e.g. ZnO thin-film) to form the sensor device. An IDT is a device that may comprise two interlocking comb-shaped arrays of metallic electrodes (in the fashion of a zipper). These metallic electrodes may be deposited on a surface of a piezoelectric substrate, such as quartz, to form a periodic structure. IDTs function may be to convert electric signals to surface acoustic waves by generating periodically distributed mechanical forces via piezoelectric effect (input transducer).

[0013] The same principle is applied to the conversion of surface acoustic waves back to electric signals (output transducer).

[0014] A thickness of the surface acoustic wave sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 100 μm. According to the present invention, the thickness of the sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 50 μm. In an example, the thickness of the sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 25 μm. These minor thicknesses of the sensor device allow an application of the sensor device on the guidewire without changing the cross section of the guidewire as the sensor device does not form a considerable protrusion on the guidewire and it is further not necessary to e.g. introduce a recess for the sensor into the guidewire.

[0015] According to the present invention, the sensor device is directly coated on the guidewire. In an example, the sensor device is directly coated on an electrical insulated layer of the guidewire. The electrical insulated layer may be a polymer based hydrophobic/hydrophilic coating. In another example, the sensor device is indirectly coated on an additional, flexible substrate of e.g. polyimide and then attached and e.g. glued on or around the guidewire.

[0016] The coating process is described further below and allows an application of the sensor device on the guidewire without changing the cross section of the guidewire. For example, the cross section remains circular or square. This is achieved by coating the guidewire with a very thin sensor device instead of e.g. introducing a recess into the guidewire for e.g. a larger sensor.

[0017] The coating process further allows an application of the sensor device on the guidewire without changing the mechanical properties of the guidewire. This is achieved by coating the guidewire without the application of heat or other influences harming the guidewire materials. As the cross section and the mechanical properties of the guidewire remain unamended, also the properties and in particular the haptic feel of the entire guidewire system is maintained, which eases the application by a user.

[0018] In an example, the guidewire system has a diameter in a range of 0.05 to 1 mm, preferably 0.1 to 0.5 mm.

[0019] According to the present invention, also a measuring system is presented. The measuring system comprises a processing device and the guidewire system as described above. The processing device is arranged distant to the sensor device of the guidewire system. The processing device is configured for a communication with the sensor device. In an example, the processing device is configured for detecting a position of the sensor device. Therefore, the processing device may be configured to emit at least a signal, to receive the reflected signal(s) and to process a time delay between the emitted and the received signal into a distance or a position of the sensor device.

[0020] The guidewire system comprises a guidewire and a surface acoustic wave sensor device. A portion of a surface of the guidewire is coated by the surface acoustic wave sensor device. The surface acoustic wave sensor device comprises a piezoelectric substrate and a transducer. In an example, the sensor device is configured for measuring a pressure change. The guidewire system may comprise a plurality of surface acoustic wave sensor devices.

[0021] A thickness of the surface acoustic wave sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 100 μm. According to the current invention, the thickness of the sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 50 μm.

[0022] According to the present invention, also a method for manufacturing a guidewire system is presented. It comprises the following steps, not necessarily in this order:

a) providing a guidewire, and
b) coating a portion of a surface of the guidewire by a surface acoustic wave sensor device.

[0023] The sensor device comprises a piezoelectric substrate and a transducer. The thickness of the sensor device perpendicular to a longitudinal direction of the guidewire is smaller than 50 μm.

[0024] In an example, the coating step maintains the cross section of the guidewire. This is achieved by coating the guidewire with the very thin sensor device instead of e.g. introducing a recess into the guidewire for e.g. a larger sensor. In an example, the coating step maintains the mechanical properties of the guidewire. This is achieved by coating the guidewire without the application of heat or other influences harming the guidewire materials or inducing micro structural transformations or defects. In an example, the coating step is therefore a sol gel process. The sol gel process may be carried out by means of contacting a substrate to a liquid, for example, by means of immersing into the liquid or by means of spraying the liquid onto the substrate to be coated. Multiple layers can be applied in identical or different manner. Even multiple equal layers can be applied in different manner, that is, for example by means of immersing on one case and by means of spraying in another case. The layer or coating is formed by means of depositing particles from a colloidal solution or dispersion.

[0025] In another example, the coating step is therefore a sputtering process. The sputtering process may be a chemical vapor deposition (CVD) process and in particular a low pressure chemical vapor deposition (LPCVD). Thereby, a wafer or substrate is exposed to one or more volatile precursors, which react and/or decompose on the substrate surface to produce the desired deposit. The sputtering process may be a physical vapor deposition (PVD) process which is a vacuum deposition method. Thereby, a vapor of material is produced, which is then deposited on an object to be coated.

[0026] It shall be understood that the guidewire system, the measuring system, and the method for manufacturing such guidewire system according to the independent claims have similar and/or identical preferred embodiments, in particular, as defined in the dependent claims. It shall be understood further that a preferred embodiment of the invention can also be any combination of the dependent claims with the respective independent claim.

[0027] These and other aspects of the present invention will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Exemplary embodiments of the invention will be described in the following with reference to the accompanying drawings:

Fig. 1 shows a schematic drawing of an example of a measuring system according to the invention.

Fig. 2 shows schematically and exemplarily an embodiment of a guidewire system 10 according to the invention.

Fig. 3 shows basic steps of an example of a method for manufacturing a guidewire system according to the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0029] Guidewires have particular application in minimally invasive medical procedures where they are used to guide catheters or other medical devices to a target site within the human or animal body. The guidewire is typically advanced to a desired target site, such as a diagnosis or treatment site, for example the site of a lesion or blockage in a vein or artery or other body lumen. Other interventional medical devices, such as guide catheters, therapeutic catheters, or diagnostic catheters, are introduced over or along the guidewire and directed through sometimes tortuous vasculature to the site of the arterial or venous or other blockage, lesion or treatment site.

[0030] Guidewires are used in minimally invasive percutaneous transluminal coronary angioplasty (PTCA) and peripheral angioplasty procedures. In PTCA procedures, a guidewire is typically inserted into the femoral artery of a patient near the groin, advanced over the aortic arch, through a coronary ostium and into a coronary artery to a target site. A guidewire insertion procedure is typically performed in a hospital setting using fluoroscopy to visualise and assist the advancement of the guidewire to the desired target site.

[0031] Other medical uses of guidewires include, without limitation, use in urinary, gastro-intestinal, pulmonary and bilary applications. Guidewires are also used in other interventional, investigative and surgical applications and procedures.

[0032] The principle function of the known guidewire is to facilitate access to a remote location within a body lumen, thereby making the location of the site available to adjuvant diagnostic or treatment devices. This is achieved by providing the guidewire as a flexible wire which is capable of traversing bodily channels, vessels or passageways (generally referred to as lumens) which are often extremely tortuous. The guidewire is sufficiently flexible to be navigable to the desired site without damaging the walls of the vessels it passes through. Also as mentioned above, once the guidewire has been positioned at the desired location, it is used as a guide over or along which other devices can be accurately guided to or placed at the target site. For example, in balloon angioplasty, a catheter having a balloon at its distal tip is introduced, using the guidewire to guide it, to an area of a blood vessel which is blocked or partially blocked by atherosclerotic deposits (plaque). The atherosclerotic deposits on the vessel wall reduce or prevent blood flow. The balloon is inflated at the site of the plaque to compress the plaque against the vessel wall thereby opening the blocked or partially blocked vessel to the flow of blood. In a related procedure, a stent may be advanced over or along the guidewire to the site of blockage and deployed there to provide an artificial scaffolding which maintains the vessel in the open state in which good blood flow occurs.

[0033] **Fig. 1** shows schematically and exemplarily an embodiment of a measuring system 1 according to the invention. The measuring system 1 comprises a processing device 20 and a guidewire system 10.

[0034] The guidewire system 10 comprises a guidewire 11 and a surface acoustic wave sensor device 12. A portion of a surface of the guidewire 11 is coated with at least one surface acoustic wave sensor device 12 to measure a pressure change. A thickness of the surface acoustic wave sensor device 12 perpendicular to a longitudinal direction of the guidewire 11 is smaller than 100 μm.

[0035] The processing device 20 is arranged distant to the surface acoustic wave sensor device 12 of the guidewire system 10. The processing device 20 is configured for a communication with the sensor device 12.

[0036] The surface acoustic wave sensor device 12 comprises a piezoelectric substrate 13 and a transducer 14. The transducer 14 is an interdigital transducer (IDT). The IDT comprises two interlocking comb-shaped arrays of metallic electrodes or antennas and may work as follows. A radio signal induces a current in e.g. a first, in Fig. 1 left antenna which induces surface acoustic waves on the piezoelectric substrate 13. The same antenna sends back an echo. A second, in Fig. 1 right antenna is placed on the same piezoelectric substrate 13 and also sends an echo with a time delay due to a defined distance to the first antenna. This time delay depends mainly on an acoustic wave speed on the piezoelectric substrate 13 and the distance. The acoustic wave speed of the substrates may depend on the material, mechanical constrains and/or temperature.

[0037] **Fig. 2** shows schematically and exemplarily an embodiment of a guidewire system 10 according to the invention. As shown in Fig. 2, the guidewire system 10 is configured for measuring a pressure change in front and after a vasoconstriction to e.g. perfectly position a stent. A portion of a surface of the guidewire 11 is coated by several surface acoustic wave sensor devices 12. Each or at least some of the surface acoustic wave sensor devices 12 are configured for measuring a pressure change. Each or at least some of the surface acoustic wave sensor devices 12 comprise a piezoelectric substrate 13 and a transducer 14. The transducer 14 is an interdigital transducer (IDT). The IDT comprises here gold thin-film printed electrical paths provided on a ZnO thin-film piezoelectric substrate 13.

[0038] The guidewire system 10 according to the invention allows integrating a sensor device 12 in a guidewire 11 without changing the haptic feel of the guidewire 11. The unamended haptic feel and the improved handiness can be used to locate and/or classify a stenosis or another disease state within arteries and/or veins. The haptic feel may also be used to determine a location for an implantable device within the vasculature, such as a stent, a heart valve or the like.

[0039] **Fig. 3** shows a schematic overview of steps of a method for manufacturing a guidewire system 10. The method comprises the following steps, not necessarily in this order:

- In a first step S1, providing a guidewire 11, and
- In a second step S2, coating a portion of a surface of the guidewire 11 by a surface acoustic wave sensor device 12.

[0040] The sensor device 12 comprises a piezoelectric substrate 13 and a transducer 14. The thickness of the sensor device 12 perpendicular to a longitudinal direction of the guidewire 11 is smaller than 100 μm.

[0041] The coating step maintains the cross section of the guidewire 11 by coating the guidewire 11 with the very thin sensor device 12 instead of e.g. introducing a recess into the guidewire 11 for e.g. a larger sensor. The coating step also maintains the mechanical properties of the guidewire 11 by coating the guidewire 11 without the application of heat or other influences harming the guidewire materials or inducing micro structural transformations or defects. The coating step may be a sol gel process or a sputtering process.

[0042] As the cross section and the mechanical properties of the guidewire 11 remain unamended, also the properties and in particular the haptic feel of the entire guidewire system 10 is maintained, which eases the application by a user.

[0043] It has to be noted that embodiments of the invention are described with reference to different subject matters. In particular, some embodiments are described with reference to method type claims whereas other embodiments are described with reference to the device type claims. However, a person skilled in the art will gather from the above and the following description that, unless otherwise notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters is considered to be disclosed with this application. However, all features can be combined providing synergetic effects that are more than the simple summation of the features.

[0044] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing a claimed invention, from a study of the drawings, the disclosure, and the dependent claims.

[0045] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items re-cited in the claims. The mere fact that certain measures are re-cited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A guidewire system (10), comprising:

   - a guidewire (11), and
   - a surface acoustic wave sensor device (12),

   wherein a portion of a surface of the guidewire (11) is coated by the sensor device (12),
   wherein the sensor device (12) comprises a piezoelectric substrate (13) and a transducer (14),
   characterized in that
   a thickness of the sensor device (12) perpendicular to a longitudinal direction of the guidewire (11) is smaller than 50 μm,
   wherein the sensor device is directly coated on the guidewire (11), and
   wherein the piezoelectric substrate (13) of the sensor device (12) is directly coated on the guidewire (11).

2. Guidewire system (10) according to one of the preceding claims, wherein the guidewire system (10) has a diameter in a range of 0.05 to 1 mm.

3. Guidewire system (10) according to one of the preceding claims, wherein the guidewire system (10) has a diameter in a range of 0.1 to 0.5 mm.

4. Guidewire system (10) according to one of the preceding claims, wherein the piezoelectric substrate (13) is made of zinc oxide, aluminium nitride, silicon dioxide, barium titanate, lead zirconate titanate, sodium potassium niobat and/or lithium niobat.

5. Guidewire system (10) according to one of the preceding claims, wherein the transducer (14) is an interdigital transducer.

6. Guidewire system (10) according to one of the pre-

ceding claims, wherein the sensor device (12) is configured for measuring a pressure change in front and after a vasoconstriction.

7. A measuring system (1) comprising:

- a guidewire system (10) according to one of the preceding claims, and
- a processing device (20),

wherein the processing device is arranged distant to a sensor device (12) of the guidewire system (10), and
wherein the processing device (20) is configured for a communication with the sensor device (12).

8. Measuring system (1) according to the preceding claim, wherein the processing device (20) is configured for detecting a position of the sensor device (12).

9. A method for manufacturing a guidewire system (10), comprising the following steps:

- providing a guidewire (11), and
- coating a portion of a surface of the guidewire (11) by a surface acoustic wave sensor device (12),

wherein the sensor device (12) comprises a piezoelectric substrate (13) and a transducer (14),
characterized in that
a thickness of the sensor device (12) perpendicular to a longitudinal direction of the guidewire (11) is smaller than 50 μm
wherein the sensor device is directly coated on the guidewire (11), and
wherein the piezoelectric substrate (13) of the sensor device (12) is directly coated on the guidewire.

10. Method according to the preceding claim, wherein the coating step is a sputtering process.

11. Method according to claim 9, wherein the coating step is a sol gel process.

12. Method according to one of the preceding claims, wherein the coating step maintains the cross section of the guidewire (11).

13. Method according to one of the preceding claims, wherein the coating step maintains the mechanical properties of the guidewire (11).

Patentansprüche

1. Ein Führungsdrahtsystem (10), umfassend:

- einen Führungsdraht (11) und
- eine Oberflächenschallwellen-Sensorvorrichtung (12),

worin ein Teil einer Oberfläche des Führungsdrahts (11) mit der Sensorvorrichtung (12) beschichtet ist, wobei die Sensorvorrichtung (12) ein piezoelektrisches Substrat (13) und einen Wandler (14) umfasst,
dadurch gekennzeichnet, dass
eine Dicke der Sensorvorrichtung (12) senkrecht zu einer Längsrichtung des Führungsdrahts (11) kleiner als 50 μm ist,
wobei der Führungsdraht (11) unmittelbar mit der Sensorvorrichtung (12) beschichtet ist, und
wobei der Führungsdraht (11) unmittelbar mit dem piezoelektrischen Substrat (13) der Sensorvorrichtung (12) beschichtet ist.

2. Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, wobei das Führungsdrahtsystem (10) einen Durchmesser im Bereich von 0,05 bis 1 mm aufweist.

3. Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, wobei das Führungsdrahtsystem (10) einen Durchmesser im Bereich von 0,1 bis 0,5 mm aufweist.

4. Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, wobei das piezoelektrische Substrat (13) aus Zinkoxid, Aluminiumnitrid, Siliziumdioxid, Bariumtitanat, Blei-Zirkonat-Titanat, Natrium-Kaliumniobat und/oder Lithiumniobat hergestellt ist.

5. Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, wobei es sich bei dem Wandler (14) um einen interdigitalen Wandler handelt.

6. Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, wobei die Sensorvorrichtung (12) zur Messung einer Druckänderung vor und hinter einer Gefäßverengung konfiguriert ist.

7. Ein Messsystem (1), umfassend:

- ein Führungsdrahtsystem (10) nach einem der vorherigen Ansprüche, und
- eine Verarbeitungsvorrichtung (20),

wobei die Verarbeitungsvorrichtung in einem Abstand von einer Sensorvorrichtung (12) des Führungsdrahtsystems (10) angeordnet ist, und
wobei die Verarbeitungsvorrichtung (20) für eine Kommunikation mit der Sensorvorrichtung (12) konfiguriert ist.

8. Messsystem (1) nach einem der vorherigen Ansprüche, wobei die Verarbeitungsvorrichtung (20) zur Erfassung einer Position der Sensorvorrichtung (12) konfiguriert ist.

9. Verfahren zur Herstellung eines Führungsdrahtsystems (10), das die folgenden Schritte umfasst:

- Bereitstellen eines Führungsdrahts (11), und
- Beschichten eines Teils einer Oberfläche des Führungsdrahts (11) mithilfe einer Oberflächenschallwellen-Sensorvorrichtung (12),

wobei die Sensorvorrichtung (12) ein piezoelektrisches Substrat (13) und einen Wandler (14) umfasst,
dadurch gekennzeichnet, dass
eine Dicke der Sensorvorrichtung (12) senkrecht zu einer Längsrichtung des Führungsdrahts (11) kleiner als 50 μm ist,
wobei der Führungsdraht (11) unmittelbar mit der Sensorvorrichtung beschichtet ist, und
wobei der Führungsdraht unmittelbar mit dem piezoelektrischen Substrat (13) der Sensorvorrichtung (12) beschichtet ist.

10. Verfahren nach dem vorherigen Anspruch, wobei es sich bei dem Beschichtungsschritt um ein Kathodenzerstäubungsverfahren handelt.

11. Verfahren nach Anspruch 9, wobei es sich bei dem Beschichtungsschritt um ein Sol-Gel-Verfahren handelt.

12. Verfahren nach einem der vorherigen Ansprüche, wobei der Querschnitt des Führungsdrahts (11) bei dem Beschichtungsschritt erhalten bleibt.

13. Verfahren nach einem der vorherigen Ansprüche, wobei die mechanischen Eigenschaften des Führungsdrahts (11) bei dem Beschichtungsschritt erhalten bleiben.

Revendications

1. Système de fil-guide (10) comprenant :

- un fil-guide (11), et
- un dispositif de capteur à ondes élastiques de surface (12),

dans lequel une portion d'une surface du fil-guide (11) est enduite par le dispositif de capteur (12),
dans lequel le dispositif de capteur (12) comprend un substrat piézoélectrique (13) et un transducteur (14),
caractérisé en ce que
une épaisseur du dispositif de capteur (12) perpendiculaire à une direction longitudinale du fil-guide (11) est inférieure à 50 μm,
dans lequel le dispositif de capteur est directement enduit sur le fil-guide (11), et
dans lequel le substrat piézoélectrique (13) du dispositif de capteur (12) est directement enduit sur le fil-guide (11).

2. Système de fil-guide (10) selon une des revendications précédentes, dans lequel le système de fil-guide (10) a un diamètre dans une plage de 0,05 à 1 mm.

3. Système de fil-guide (10) selon une des revendications précédentes, dans lequel le système de fil-guide (10) a un diamètre dans une plage de 0,1 à 0,5 mm.

4. Système de fil-guide (10) selon une des revendications précédentes, dans lequel le substrat piézoélectrique (13) est réalisé en oxyde de zinc, nitrure d'aluminium, dioxyde de silicium, titanate de baryum, titano-zirconate de plomb, niobate de sodium-potassium et/ou niobate de lithium.

5. Système de fil-guide (10) selon une des revendications précédentes, dans lequel le transducteur (14) est un transducteur interdigité.

6. Système de fil-guide (10) selon une des revendications précédentes, dans lequel le dispositif de capteur (12) est configuré pour mesurer un changement de pression devant et après une vasoconstriction.

7. Système de mesure (1) comprenant :

- un système de fil-guide (10) selon une des revendications précédentes, et
- un dispositif de traitement (20),

dans lequel le dispositif de traitement est agencé à distance d'un dispositif de capteur (12) du système de fil-guide (10), et
dans lequel le dispositif de traitement (20) est configuré pour une communication avec le dispositif de capteur (12).

8. Système de mesure (1) selon la revendication précédente, dans lequel le dispositif de traitement (20) est configuré pour détecter une position du dispositif de capteur (12).

9. Procédé de fabrication d'un système de fil-guide (10) comprenant les étapes suivantes :

- fournir un fil-guide (11), et
- enduire une portion d'une surface du fil-guide (11) par un dispositif de capteur à ondes élastiques de surface (12),

dans lequel le dispositif de capteur (12) comprend

un substrat piézoélectrique (13) et un transducteur (14),
caractérisé en ce que
une épaisseur du dispositif de capteur (12) perpendiculaire à une direction longitudinale du fil-guide (11) est inférieure à 50 μm,
dans lequel le dispositif de capteur est directement enduit sur le fil-guide (11), et
dans lequel le substrat piézoélectrique (13) du dispositif de capteur (12) est directement enduit sur le fil-guide.

10. Procédé selon la revendication précédente, dans lequel l'étape d'enduction est un processus de pulvérisation.

11. Procédé selon la revendication 9, dans lequel l'étape d'enduction est un processus sol-gel.

12. Procédé selon une des revendications précédentes, dans lequel l'étape d'enduction maintient la section transversale du fil-guide (11).

13. Procédé selon une des revendications précédentes, dans lequel l'étape d'enduction maintient les propriétés mécaniques du fil-guide (11).

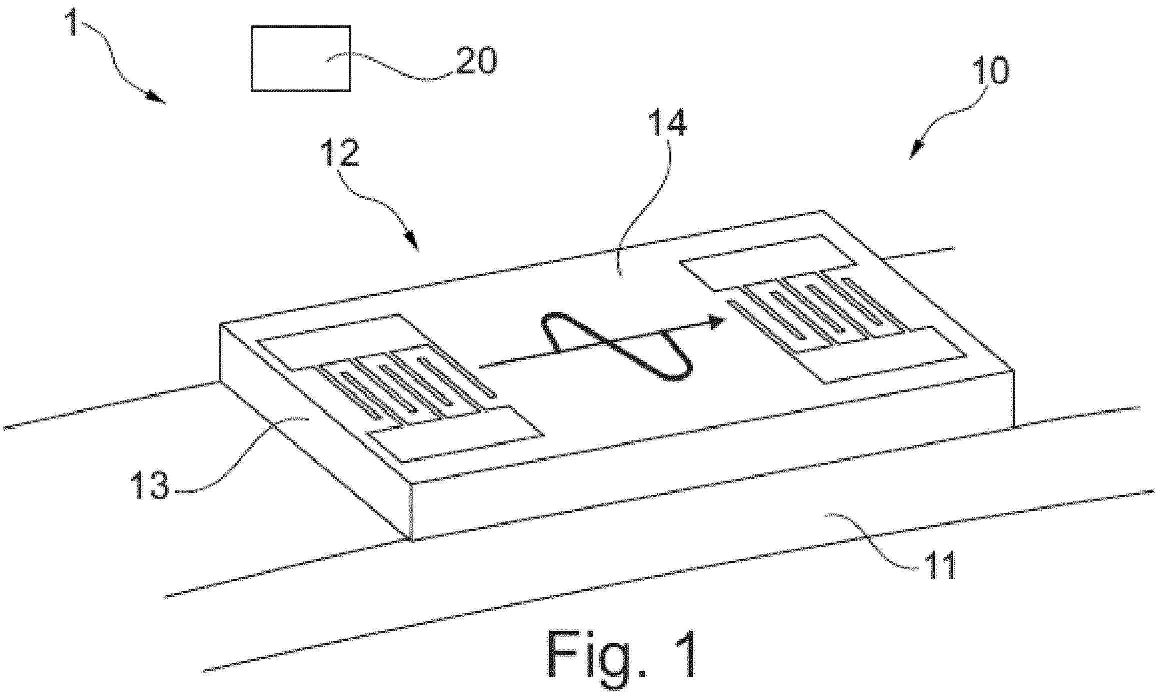

Fig. 1

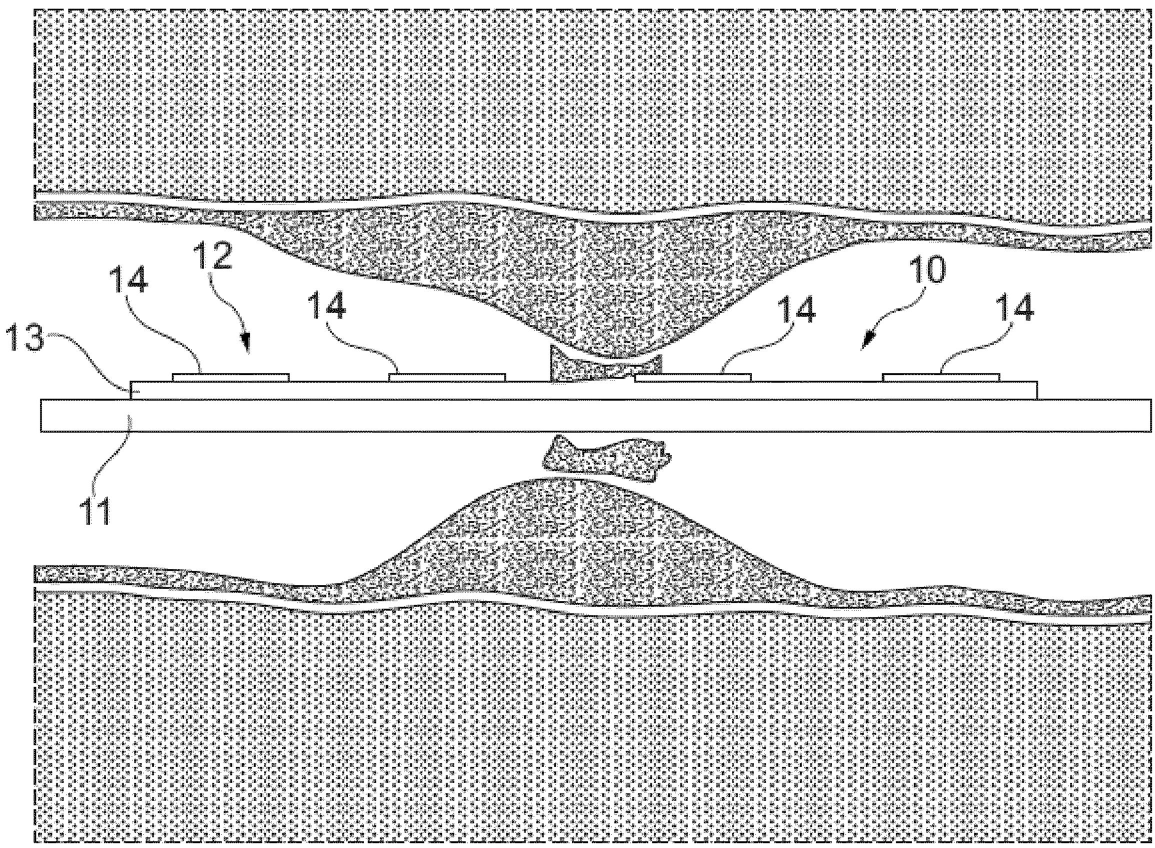

Fig. 2

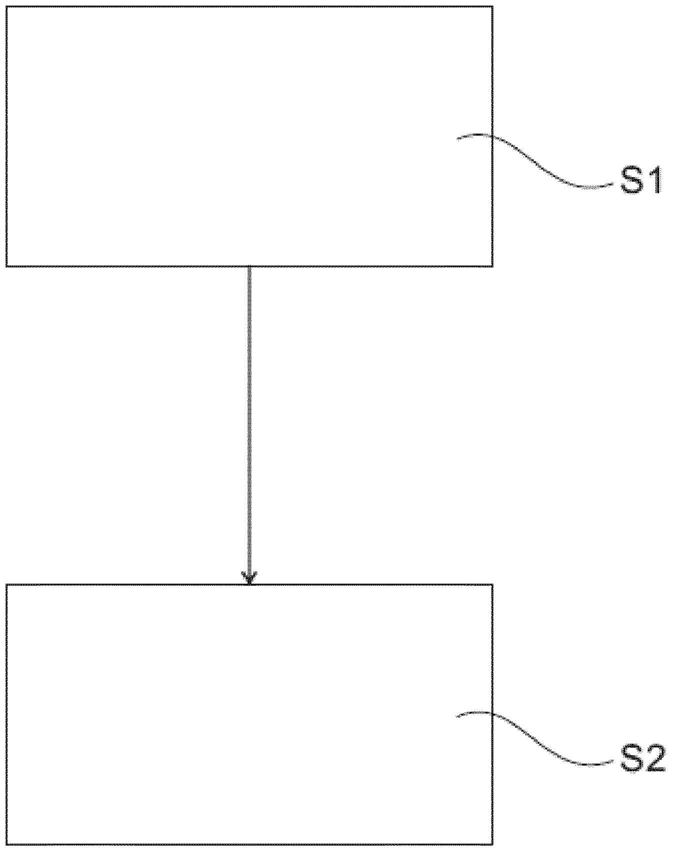

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 03030752 A1 **[0002]**
- EP 1837638 A1 **[0002]**

专利名称(译)	导丝系统和制造导丝系统的方法		
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IPC分类号	A61B5/00 A61B5/0215		
CPC分类号	A61M25/09041 A61B5/0215 A61B5/6851 A61B8/0841 A61B34/20 A61B34/76 A61B2034/2063 A61B2090/065 A61B2090/3788 A61M25/0108 A61M2025/09108 A61M2205/0294		
其他公开文献	EP3254610A1		
外部链接	Espacenet		

摘要(译)

导丝系统，测量系统和制造这种导丝系统的方法本发明涉及导丝系统，测量系统和制造这种导丝系统的方法。导丝系统包括导丝和表面声波传感器装置。导丝表面的一部分由表面声波传感器装置涂覆。表面声波传感器装置可以配置用于测量压力变化。表面声波传感器装置包括压电基板和换能器。垂直于导丝纵向的表面声波传感器装置的厚度小于100μm。

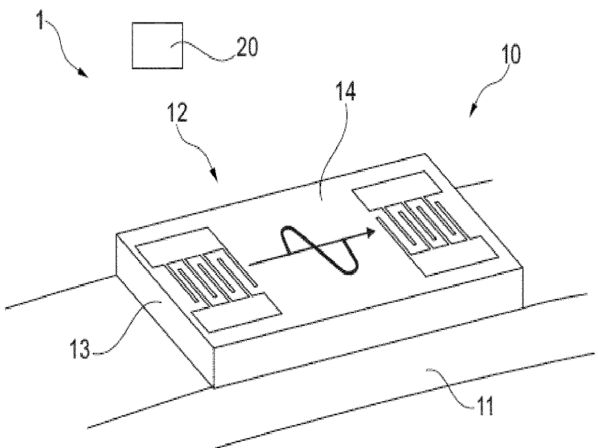

Fig. 1