(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 August 2016 (04.08.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/120122 A1

(51) International Patent Classification:
G01R 31/26 (2006.01) *G01R 31/28* (2006.01)

(21) International Application Number:
PCT/EP2016/050977

(22) International Filing Date:
19 January 2016 (19.01.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1550606 27 January 2015 (27.01.2015) FR

(71) Applicants: **SOITEC** [FR/FR]; Parc Technologique des Fontaines, Chemin des Franques, 38190 Bernin (FR). **UNIVERSITE CATHOLIQUE DU LOUVAIN** [BE/BE]; Place de l'Université 1, 1348 Louvain (BE).

(72) Inventors: **MALAQUIN, Cédric**; 87 chemin du plan, 38530 Pontcharra (FR). **RASKIN, Jean-Pierre**; Rue de la Brasserie, 17, 5310 Saint Germain (BE). **DESBONNETS, Eric**; 460 Chemin des Grangettes, 38660 Lumbin (FR).

(74) Agent: **IP TRUST**; 2 rue de Clichy, 75009 Paris (FR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: METHOD, DEVICE AND SYSTEM FOR MEASURING AN ELECTRICAL CHARACTERISTIC OF A SUBSTRATE

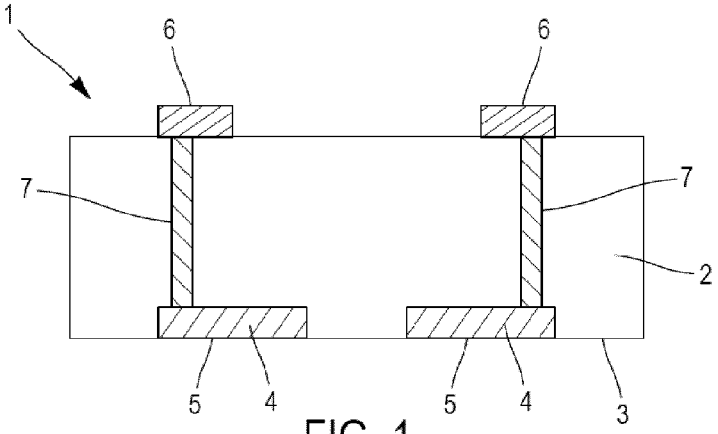

FIG. 1

(57) Abstract: The invention relates to a device for measuring an electrical characteristic of a substrate comprising a support made of a dielectric material having a bearing surface, the support comprising an electrical test structure having a contact surface flush with the bearing surface of the support, the bearing surface of the support and the contact surface of the electrical structure being suitable for coming into close contact with a substrate. The measurement device also comprises at least one connection bump contact formed on another surface of the support and electrically linked to the electrical structure. The invention relates also to a system for characterizing a substrate and a method for measuring a characteristic of a substrate employing the measurement device.

WO 2016/120122 A1

METHOD, DEVICE AND SYSTEM FOR MEASURING AN ELECTRICAL CHARACTERISTIC OF A SUBSTRATE

FIELD OF THE INVENTION

The present invention relates to the field of the characterization of the electrical, notably radiofrequency (RF), performance levels of substrates that can be employed for the fabrication of microelectronic, optoelectronic, micromechanical or photovoltaic devices.

TECHNOLOGICAL BACKGROUND OF THE INVENTION

Integrated devices are usually formed on substrates which serve mainly as supports for their fabrication. However, the increase in the degree of integration and in the performance levels expected of these devices is leading to an increasingly significant coupling between their performance levels and the characteristics of the substrate on which they are formed. Such is particularly the case with RF devices, which deal with signals with a frequency of between approximately 3 kHz and 300 GHz, which are notably applicable in the field of telecommunications (telephony, Wi-Fi, Bluetooth, etc.).

As an example of device/substrate coupling, the electromagnetic fields, derived from the high-frequency signals that are propagated in the devices, penetrate into the depth of the substrate and interact with any charge carriers which are located therein. The result thereof is a pointless consumption of a portion of the energy of the signal through insertion loss and possible influences between components by crosstalk.

It is therefore particularly important to ensure a suitable match between the electrical characteristics of the substrate and the performance levels expected of the devices.

One usual technique for measuring the electrical characteristics of a substrate for the fabrication of RF devices consists in forming a test structure on this substrate by employing the usual microelectronic fabrication means: deposition, masking, etching, etc. The test structure can thus be designed to measure a particular characteristic of the substrate (such as, for example, its resistance, its linearity, its capacitance, its permittivity) and/or characterize its suitability for a particular application considered. The test structure can, for example, consist of coplanar lines in which a signal from a generator is propagated. A signal analyser is used to identify the power dissipated in the substrate and deduce therefrom the insertion loss characteristic.

The known techniques, like those which have just been described, are not entirely adequate. They in fact require the implementation of significant means, for example for the production of the test structures on the substrate, which are slow and costly. These means cannot be automated, or can be automated only to a small extent, and they are, moreover, destructive techniques. They are not therefore suitable for operating a substrate production control or substrate quality control on the input side of a device production line. Each measured characteristic must, in addition, be the subject of a separate test. Finally, these known techniques, although they make it possible to locally measure an electrical characteristic, are not suited to producing a mapping of this characteristic over the entire surface of the substrate. They do not therefore make it possible to accurately characterize this substrate.

OBJECT OF THE INVENTION

One aim of the invention is therefore to propose a method and a device for measuring an electrical characteristic of a substrate and a system for characterizing a substrate which are easy to implement, inexpensive and multi-purpose.

Another aim of the invention is to propose a measurement method and device and an accurate characterization system, which notably make it possible to provide the mapping of an electrical characteristic over the entire surface of a substrate.

Another aim of the invention is also to propose a method and a device for measuring an electrical characteristic and a system for characterizing a substrate upon which it is possible to base a control of production or of quality of these substrates.

BRIEF DESCRIPTION OF THE INVENTION

In order to achieve at least one of these aims, the object of the invention proposes a device for measuring an electrical characteristic of a substrate comprising a support made of a dielectric material having a bearing surface, the support comprising an electrical test structure having a contact surface flush with the bearing surface of the support, the bearing surface of the support and the contact surface of the electrical structure being suitable for coming into close contact with a substrate. The measurement device also comprises at least one connection bump contact formed on another surface of the support and electrically linked to the electrical structure.

Thus, the measurement device can be applied to a chosen point of a main face of the substrate to be tested for a measurement to be able to be performed rapidly, without damaging the substrate.

Advantageously, the measured characteristic is a radiofrequency (RF) characteristic and the electrical test structure comprises at least one active or passive RF component. The RF component can be a transmission line, an

inductor, a contactor, a crosstalk characterizing component, an antenna, a resonator.

There is thus a device for measuring an RF characteristic of a substrate.

In a variant, the measured characteristic can also be a static characteristic.

Particularly advantageously, the dielectric support is rigid, which facilitates its handling and its placement in close contact with the substrate.

Preferably, the connection bump contact of the support is formed on the face opposite the bearing surface of the support, which simplifies its interconnection in the system.

Advantageously, the support comprises a via filled with an electrically conductive material to electrically link the electrical test structure to the connection bump contact. The device is thus more compact.

The object of the invention relates also to a system for characterizing a substrate comprising the measurement device according to the invention.

Advantageously, the characterization system comprises a plate for positioning the substrate thereon, and this plate can be configured to apply a voltage to the substrate.

Particularly advantageously, the characterization system also comprises means for relatively displacing the measurement device with respect to the plate. These means make it possible to easily produce a mapping of the electrical characteristic measured over the entire surface of the substrate.

Preferentially, the characterization system comprises a holding member, secured to the support, and configured to place the support in close contact with the substrate.

Preferentially, the characterization system comprises an analysis computer connected to the connection bump contact of the support, the analysis computer comprising an electrical signal source and a signal analyser. There is then an integrated measurement system capable of applying, tapping and processing a measurement signal to provide the characterization information.

Another object of the invention relates to a method for measuring an electrical characteristic of a substrate comprising the following steps:

a) supplying a substrate having a main face;
b) placing the main face of the substrate in close contact, by joining in a contact zone, with a contact surface of an electrical test structure;
c) propagating a signal in the electrical test structure while maintaining the close contact;
d) measuring the signal propagated to determine the electrical characteristic of the substrate.

According to other features of this method, taken alone or in combinations:

- the electrical test structure is included in a support made of a dielectric material, the contact surface of the electrical structure being flush with a bearing surface of the support.

- The step of placing in close contact consists in placing the support on the main face of the substrate, in the contact zone, then in applying a controlled holding force on the support during the propagation step c) and the measurement step d).

- The measurement sequence, consisting in performing the succession of the steps B to D, is repeated.

- The measurement sequence is applied in distinct contact zones of the main face of the substrate.

- The method comprises, after the measurement step d), a step e) of removal of the electrical structure from the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will emerge from the detailed description of the invention which follows with reference to the attached figures in which:

- Figure 1 represents a schematic block diagram of the measurement device according to the invention;

- Figure 2 represents a schematic block diagram of the system for characterizing a substrate according to the invention;

- Figure 3 represents the main steps of the measurement method according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 2, a system 10 for characterizing a substrate 11 has been represented.

The substrate 11 can be of any kind: it can be a semiconductive substrate, such as a silicon substrate, or an insulating substrate, for example made of sapphire. It can also be a compound substrate such as a silicon on insulator substrate. Preferably, the substrate is unprocessed, that is

to say that the substrate does not contain any functional devices.

In the system 10, a plate 7 has been provided to receive the substrate 11. As is well known in itself, the plate can be provided with means making it possible to hold the substrate in place, mechanically or even by vacuum. The substrate 11 can be positioned on the plate via a manipulating robot which is not represented in Figure 2.

The characterization system 10 also comprises a device 1 for measuring an electrical characteristic of the substrate, a detailed description of which will be given later. This measurement device makes it possible to apply and/or extract a signal propagated on the surface and in proximity to the surface of the substrate 11.

To this end, and as is represented in Figure 2, the measurement device is placed in close contact with the substrate 11. To do this, the system 10 is provided with a holding member 8 secured to the measurement device 1. It can, for example, be an articulated arm that can be controlled by the computer 9, and capable of applying a controlled holding force onto the device 1 in order to press it against the substrate 11.

The measurement device 1 can comprise, on the side of its bearing surface 3 in contact with the substrate 11, sensors making it possible to adjust the holding force applied by the holding member 8 onto the measurement device 1.

The characterization system 10 is also provided with means that make it possible to adjust the relative position of the plate 7 with respect to the measurement device 1. The measurement device 1 can then be placed and moved to a chosen point of the main face of the substrate 11.

In a first configuration of the system, these means can correspond to the articulated arm forming the holding member 8 given by way of example previously.

In a second configuration, the plate 7 can be made mobile by a robot 12 capable of moving in all the directions of the plane in which it lies. This second configuration is preferred, because it avoids moving the measurement device 1 which can be fragile.

Obviously, these two means of adjusting the relative position of the plate 7 and of the measurement device 1 can be combined.

The characterization system also comprises an analysis computer 9. This computer can handle the control of the different mobile elements of the system (the holding member 8, the robot 12) and the sequencing of the measurement method which will be described later. To this end, it is linked to all the elements of the system with which it is likely to communicate.

The analysis computer 9 can also comprise an electrical signal generator 9a and an analyser 9b. The generator 9a and/or the analyser 9b are connected to the connection bump contact(s) of the measurement device 1. It is thus possible to apply, propagate and/or tap a signal from the measurement device 1.

The measurement can be processed by the computer 9 to supply the characterization of the substrate 11.

A set of measurements can also be processed by the computer 9 to establish a more comprehensive characterization, such as a characterization mapping of the substrate 11.

The system 10 therefore forms an automated assembly for characterizing a substrate which is well suited to

incorporation in a production line, for example for substrate production control or for substrate quality control.

An essential element of the system 10 lies in the measurement device 1 which will be described in the following paragraphs.

The inventors of the present application found, totally unexpectedly, that it was not essential to form the electrical test structures directly on and in the substrate 11 by using the traditional techniques of deposition, masking, etching of the microelectronic to apply and extract usable electrical signals from this test structure.

They found in fact that it was sufficient, subject to certain precautions being taken, to position these electrical test structures in close contact with the substrate by joining them together.

Figure 1 represents a schematic block diagram of such a measurement device 1 according to the invention. It comprises a support 2 made of a dielectric material, such as glass, alumina, a polymer, quartz, sapphire, SiC, etc.

Preferably, particularly in the case where the measurement device 1 is incorporated in the characterization system which has been described previously, this support 2 is rigid.

The support 2 has a bearing surface 3 and comprises an electrical test structure 4 with an exposed contact surface 5 flush with the bearing surface 3 of the support 2. This side of the device 1 therefore has a planar surface, made up of the bearing surface 3 and the contact surface 5, suitable for coming into close contact with the substrate 11.

"Close contact" should be understood to mean, in the present application, that a satisfactory electromagnetic

coupling is formed between the electrical test structure 4 and the substrate 11.

This satisfactory coupling is obtained, for example, when the surfaces in contact are sufficiently planar and/or smooth to avoid the formation of air pockets between the measurement device 1 and the substrate 11, which could affect the propagation of the electrical signal in the electrical test structure 4 or in the substrate 11 and disturb the measurement.

A holding force applied onto the measurement device 1 contributes to this close contact condition.

The electrical test structure 4 can consist of any kind of RF components, which are active or passive, making it possible to propagate a signal useful to the characterization of the substrate. They can be transmission lines, an inductor, a crosstalk characterizing component, switches, antennas, resonators, etc. The electrical test circuit 4 is therefore chosen according to the characteristic or the performance of the substrate that is to be characterized: resistance, linearity, capacitance, permittivity, etc.

As is well known in itself, the electrical test structure 4 can be formed by a number of elements, such as lines or bump contacts that are electrically separate, but coupled electromagnetically together and with the substrate 11.

In order to be able to apply and extract the signal which is propagated in the electrical test structure 4, the support 2 is provided with at least one connection bump contact 6 formed on a face of the support 2 distinct from the bearing face 3 and electrically linked to the electrical test structure 4.

Preferably, the bump contact or contacts are formed on the surface opposite the bearing surface 3 of the support 2. Also preferably, the support 2 comprises one or more vias 7 filled with an electrically conductive material to electrically link the electrical structure 4 and the connection bump contacts 6.

There now follows a description, with reference to Figure 3, of the method for measuring an electrical characteristic of a substrate 11.

This method comprises a first step a) consisting in supplying the substrate 11 to be measured. As has been seen previously, this step can consist in placing, in an automated manner, the substrate 11 on a plate 7 of the characterization system 10.

In a second step b), the contact surface 5 of the electrical test structure 4 is placed in close contact, by joining together, with a contact zone of the main face of the substrate 11.

This step can consist in employing the holding member 8 of the characterization system secured to the device 1 to position this device 1 against the substrate 11. Optionally, a controlled holding force is applied. During this step, and as was explained previously, a satisfactory electromagnetic coupling is created between the electrical test structure 4 and the substrate 11.

In a third step c), a signal is propagated in the electrical structure 4 while maintaining the close contact with the substrate 11. In a final step d), the propagated signal is measured to determine the electrical characteristic of the substrate 11.

The signal can be obtained from the source 9a of the computer 9 and the measurement can be performed by the

analyser 9b of the computer 9. At the end of this method, it is possible to interrupt the close contact during a removal step, and disassemble, for example via the holding member 8, the electrical test structure 4 from the substrate 11. It is then possible to directly position another substrate for a new measurement.

It should be noted that this measurement is not destructive to the substrate, and that the rate of the measurements can be very rapid.

Furthermore, the measurement sequence comprising the successive steps b) to d) can be repeated on a same substrate 11.

This repetition can be performed in a same zone of contact of the main face of the substrate 11, for example to average a set of measurements.

However, advantageously, the repeated measurement sequences are applied in distinct contact zones of the main face of the substrate 11. This makes it possible to produce a mapping of the characteristic measured over the entire surface of the substrate very effectively.

Obviously, the invention is not limited to the implementation described and variant embodiments can be added thereto without in any way departing from the scope of the invention, as is defined by the following claims.

Thus, although the measurement of an RF characteristic of a substrate has been taken as example, the invention is not limited to this type of measurement. It would also be possible to measure a static electrical characteristic, the electrical test structure then being able to consist of one or more metal blocks, making it possible to apply or measure a static quantity.

Moreover, the invention is not limited to a particular number of electrical test structures and/or of connection bump contacts. These elements of the measurement device 1 will be able to be duplicated as many times as necessary.

Finally, it is not essential for the material of the support 2 to be rigid and for the close contact to be obtained by the application of a holding force. It is in fact possible to envisage having the material of the support 2 be flexible, making it possible to ensure a close contact with a non-planar substrate to be characterized. It may also be provided with an adhesive layer allowing it to be positioned stably on the substrate 11 during the measurement, the adhesive favouring the placement in close contact and the electromagnetic coupling with the substrate.

CLAIMS

1. Device (1) for measuring an electrical characteristic of a substrate comprising:

   - a support (2) made of a dielectric material having a bearing surface (3), the support comprising an electrical test structure (4) having a contact surface flush with the bearing surface (3) of the support, the bearing surface (3) of the support (2) and the contact surface of the electrical structure (4) being suitable for coming into close contact with the substrate;

   - at least one connection bump contact (6) formed on another surface of the support (2) and electrically linked to the electrical structure (4).

2. Measurement device (1) according to Claim 1, in which the measured electrical characteristic is static, and the electrical test structure (4) comprises a block formed from an electrically conductive material.

3. Measurement device (1) according to Claim 1, in which the measured electrical characteristic is a radiofrequency characteristic and the electrical test structure (4) comprises at least one active or passive radiofrequency component.

4. Measurement device (1) according to the preceding claim, in which the electrical test structure (4) comprises at least one element chosen from the list formed from: a transmission line, an inductor, a crosstalk characterizing component, a switch, an antenna, a resonator.

5. Measurement device (1) according to Claim 1, in which the support (2) is rigid.

6. Measurement device (1) according to Claim 1, in which the support (2) is flexible.

7. Measurement device (1) according to Claim 1, in which the dielectric material of the support (2) is chosen from the list formed from: glass, alumina, a polymer, quartz, sapphire, SiC.

8. Measurement device (1) according to Claim 1, in which the connection bump contact (6) is formed on the surface opposite the bearing surface (3) of the support (2).

9. Measurement device (1) according to the preceding claim, in which the support (2) comprises a via (7) filled with an electrically conductive material to electrically link the electrical test structure (4) and the connection bump contact (6).

10. System for characterizing a substrate comprising the measurement device (1) according to one of Claims 1 to 8, and a plate (7) for receiving the substrate (11).

11. Characterization system (10) according to the preceding claim, in which the plate is configured to apply a voltage to the substrate.

12. Characterization system (10) according to Claim 10 or 11, also comprising means for relatively displacing the measurement device (1) with respect to the plate (7).

13. Characterization system (10) according to one of Claims 10 to 12, in which the measurement device (1) is secured to a holding member (8) configured to place the support (2) in close contact with the substrate.

14. Characterization system (10) according to one of Claims 10 to 13, also comprising an analysis computer (9) connected to

the connection bump contact (6) of the measurement device (1).

15. Characterization system (10) according to the preceding claim, in which the analysis computer (9) comprises an electrical signal source (9a) and an electrical signal analyser (9b).

16. Method for measuring an electrical characteristic of a substrate (11) comprising the following steps:

a) supplying a substrate (11) having a main face;

b) placing the main face of the substrate (11) in close contact, by joining in a contact zone, with a contact surface (5) of an electrical test structure (4) included in a support (2) made of a dielectric material, the contact surface of the electrical test structure (4) being flush with a bearing surface (3) of the support (2);

c) propagating a signal in the electrical structure (4) while maintaining the close contact;

d) measuring the signal propagated to determine the electrical characteristics of the substrate.

17. Measurement method according to Claim 16, in which the step of placing in close contact consists in placing the support (2) on the main face of the substrate (11) in the contact zone, then in applying a controlled holding force on the support (2) during the propagation step c).

18. Measurement method according to one of Claims 16 to 17, in which the measurement sequence consisting of the succession of the steps b) to d) is repeated.

19. Measurement method according to the preceding claim, in which the repetition of the measurement sequences is applied in distinct contact zones of the main face of the substrate (11).

20. Measurement method according to one of Claims 16 to 19, the method comprising, after the propagation step c), a step e) of removal of the electrical test structure (4) from the substrate (11).

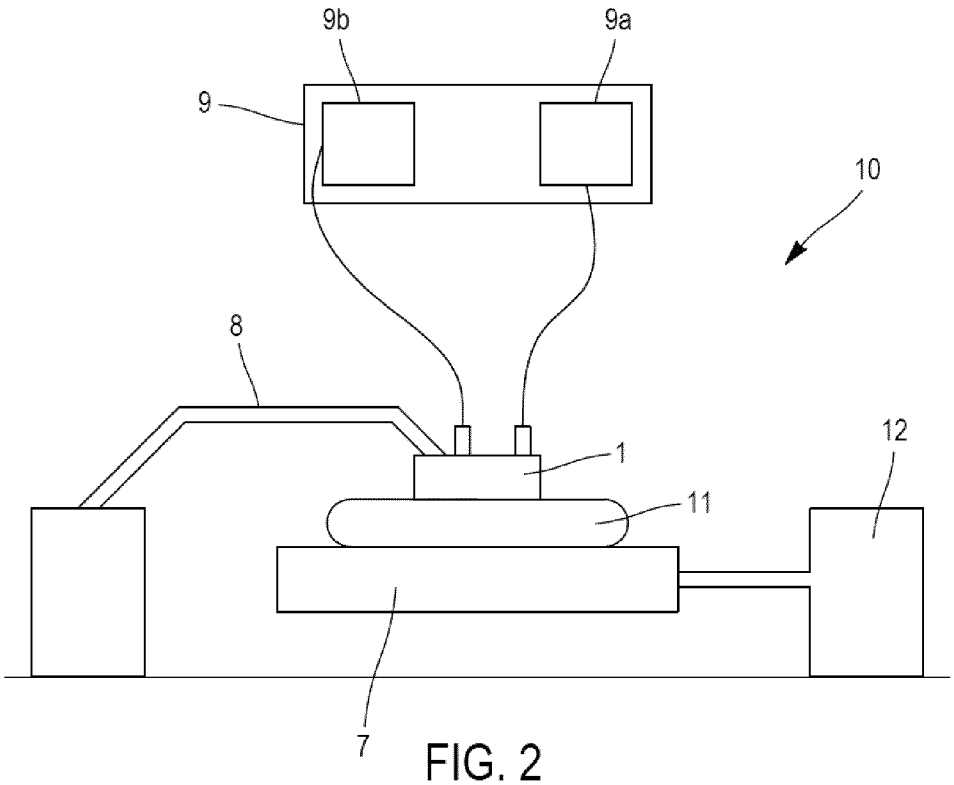

FIG. 2

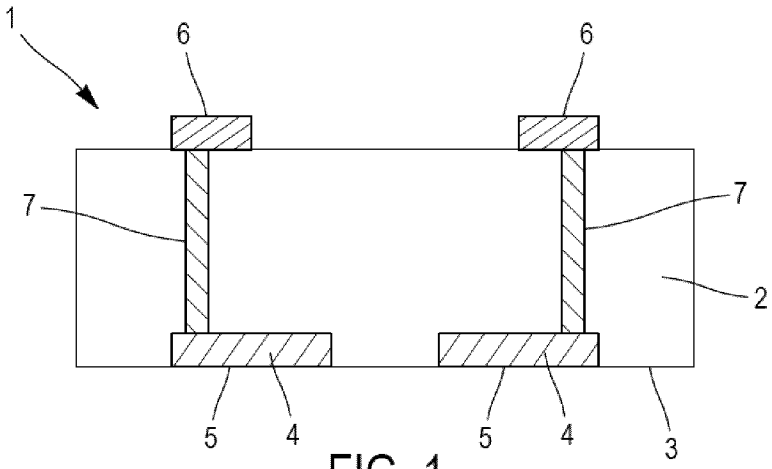

FIG. 1

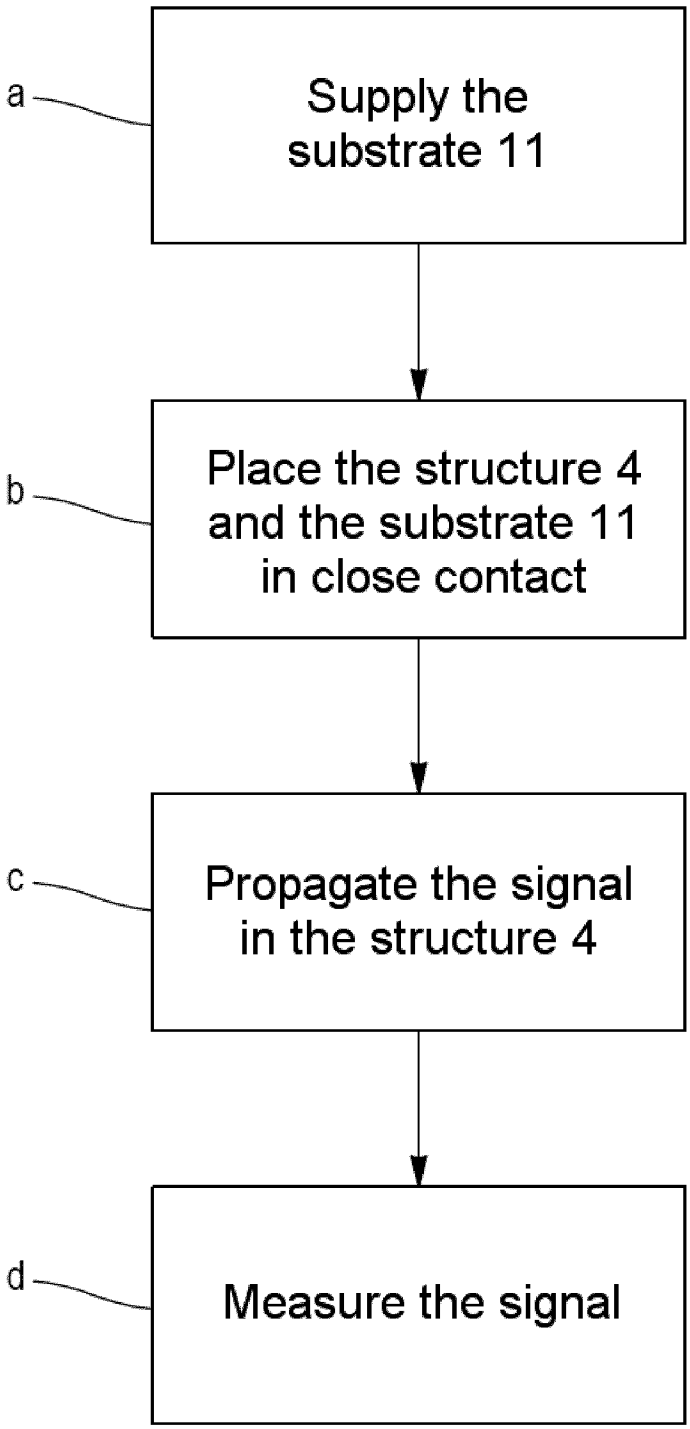
a
Supply the substrate 11
b
Place the structure 4 and the substrate 11 in close contact
c
Propagate the signal in the structure 4
d
Measure the signal

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/050977

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01R31/26 G01R31/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01R

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/074976 A1 (DURBIN AARON [US] ET AL) 29 March 2012 (2012-03-29) paragraph [0028]; figures 2,5 abstract	1-20
X	US 2013/265071 A1 (JOHNSON MORGAN [US]) 10 October 2013 (2013-10-10) paragraph [0029]; figures 3A,3B	1-20
X	US 2011/207242 A1 (LOISELET EMMANUEL [FR]) 25 August 2011 (2011-08-25) claim 1; figure 3	1-20
A	US 5 225 771 A (LEEDY GLENN J [US]) 6 July 1993 (1993-07-06) claim 1	1-20

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 February 2016	24/02/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dogueri, Ali Kerem

1

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/050977

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007/040565 A1 (JAYABALAN JAYASANKER [SG] ET AL) 22 February 2007 (2007-02-22) claim 1; figures 1,2	1-20
A	US 2008/083922 A1 (LEE YUE-SHIUN [TW] ET AL) 10 April 2008 (2008-04-10) the whole document	1-20
A	FR 2 985 812 A1 (SOITEC SILICON ON INSULATOR [FR]) 19 July 2013 (2013-07-19) claim 1; figures 1A,1B	1-20

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/050977

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012074976 A1	29-03-2012	CN 103229066 A	31-07-2013
		JP 2013540354 A	31-10-2013
		KR 20130138793 A	19-12-2013
		SG 189154 A1	31-05-2013
		US 2012074976 A1	29-03-2012
		US 2013314115 A1	28-11-2013
		US 2015015292 A1	15-01-2015
		WO 2012054201 A1	26-04-2012
US 2013265071 A1	10-10-2013	CN 104350588 A	11-02-2015
		EP 2837023 A1	18-02-2015
		JP 2015514226 A	18-05-2015
		KR 20150007305 A	20-01-2015
		SG 11201406383R A	27-11-2014
		TW 201350880 A	16-12-2013
		US 2013265071 A1	10-10-2013
		US 2015015299 A1	15-01-2015
		WO 2013154909 A1	17-10-2013
US 2011207242 A1	25-08-2011	EP 2363720 A2	07-09-2011
		GB 2477358 A	03-08-2011
		US 2011207242 A1	25-08-2011
US 5225771 A	06-07-1993	US 5225771 A	06-07-1993
		US 5451489 A	19-09-1995
		US 5629137 A	13-05-1997
		US 5654127 A	05-08-1997
		US 5725995 A	10-03-1998
US 2007040565 A1	22-02-2007	NONE	
US 2008083922 A1	10-04-2008	NONE	
FR 2985812 A1	19-07-2013	CN 104204786 A	10-12-2014
		FR 2985812 A1	19-07-2013
		JP 2015503853 A	02-02-2015
		US 2015168326 A1	18-06-2015
		WO 2013108107 A1	25-07-2013