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(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,(88) **Date of publication of the international search report:**

3 July 2014

(54) **Title:** ONE-STEP BIOMOLECULAR IMMOBILISATION PROCEDURE AND PRODUCTS THEREOF

(57) **Abstract:** The invention relates to a method for covalent immobilisation of a biomolecule to a solid material and products arising therefrom, comprising providing a solid material with an activated surface, preferably by treatment with an oxidising agent, and subsequently contacting said material with a mixture of biomolecule to be immobilised and one or more silane components, preferably present in a pre-mixed binding solution. The immobilisation procedure is particularly useful for immunoassays, enzyme-linked immunosorbent assays (ELISA), surface plasmon resonance immunoassays, microarrays or microfluidic assays.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/070919

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01L3/50857 C07K17/06 G01N33/543
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)
BOIL C07K G01N

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, EMBASE, BEI LSTEIN Data, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>CHANDRA KUMAR DIXIT ET AL: "Development of a High Sensitivity Rapid Sandwich ELISA Procedure and Its Comparison with the Conventional Approach", ANALYTICAL CHEMISTRY, VOL. 82, no. 16, 15 August 2010 (2010-08-15), pages 7049-7052, XP055048836, ISSN: 0003-2700, DOI: 10.1021/ac01339q Discussion; figure 1</p> <p style="text-align: center;">----- -/- -</p>	1-19,26

Further documents are listed in the continuation of Box C.

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
10 January 2014	16/05/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Vogt, Titus

INTERNATIONAL SEARCH REPORT

International application No PCT/EP2013/070919	
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>SANDEEP KUMAR VASHIST ET AL: "Effect of anti body immobilization strategies on the analytical performance of a surface plasmon resonance-based immunoassay" , THE ANALYST, vol . 136, no. 21, 1 January 2011 (2011-01-01) , page 4431 , XP055048842 , ISSN : 0003-2654, DOI : 10.1039/clanl5325k figure 1</p> <p>-----</p>	1-19 ,26
Y	<p>DIXIT CHANDRA KUMAR ET AL: "Multi substrate-compatible ELISA procedures for rapid and high-sensitivity immunoassays" , NATURE PROTOCOLS, NATURE PUBLISHING GROUP, GB, vol . 6, no. 4, 1 April 2011 (2011-04-01) , pages 439-445 , XP009166031 , ISSN : 1750-2799 figure 1</p> <p>-----</p>	1-19 ,26
Y	<p>US 2005/079486 A1 (ABBOTT NICHOLAS L [US] ET AL) 14 April 2005 (2005-04-14) paragraph [0084] ; figures 12,21</p> <p>-----</p>	1-19 ,26
Y	<p>WO 2010/044083 A2 (UNIV DUBLIN CITY [IE] ; VASHIST SANDEEP KUMAR [IE] ; O'SULLIVAN STEPHEN) 22 April 2010 (2010-04-22) cited in the application claims 24-37</p> <p>-----</p>	1-19 ,26
X	<p>DAN ZHENG ET AL: "Rapid and simple preparation of a reagentless glucose electrochemical biosensor" , THE ANALYST, vol . 137, no. 16, 1 January 2012 (2012-01-01) , page 3800, XP055048865 , ISSN : 0003-2654, DOI : 10.1039/c2an35128e Electrode preparation ; figure 1</p> <p>-----</p>	1-19 ,26
A	<p>YANG LUO ET AL: "Sensitive and rapid quantification of C-reactive protein using quantum dot-labeled microplate immunoassay" , JOURNAL OF TRANSLATIONAL MEDICINE, BIOMED CENTRAL, LONDON, GB, vol . 10, no. 1, 6 February 2012 (2012-02-06) , page 24, XP021118747 , ISSN : 1479-5876, DOI : 10.1186/1479-5876-10-24 the whole document</p> <p>-----</p>	1-19 ,26
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INTERNATIONAL SEARCH REPORT

International application No PCT/EP2013/070919	
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DAN ZHENG ET AL: "Mediatorless amperometric glucose biosensing using 3-aminopropyl triethoxysilane-functionalized graphene" , TALANTA, vol. 99, 15 May 2012 (2012-05-15) , pages 22-28, XP055093586, ISSN: 0039-9140, DOI : 10.1016/j.talanta.2012.05.014 figure 1	1-19 ,26
Y	----- SANDEEP KUMAR VASHIST: "Comparison of 1-Ethyl-3-(3-Dimethyl aminopropyl) Carbodiimide Based Strategies to Crosslink Antibodies on Amino-Functionalized Platforms for Immunodiagnostics" , DIAGNOSTICS, vol. 2, no. 3, 27 August 2012 (2012-08-27) , pages 23-33 , XP055093581 , DOI : 10.3390/diagnostics2030023 figure 1	1-19 ,26
Y, P	----- SANDEEP KUMAR VASHIST: "A sub-parallel cogenerated sensitive rapid chemiluminescent immunoassay for the detection of human fetal nA", BIOSENSORS AND BIOELECTRONICS, vol. 40, no. 1, 1 February 2013 (2013-02-01) , pages 297-302 , XP055093588, ISSN: 0956-5663 , DOI : 10.1016/j.bios.2012.07.067 figure 1	1-19 ,26
X	----- EP 1 365 249 A1 (NGK INSULATORS LTD [JP]) 26 November 2003 (2003-11-26) claim 15	1-19 ,26
X, P	----- S K VASHIST ET AL: "Rapid Immunodiagnostics Kits based on proprietary 1-step chemistry for covalent and cleavage-proof antibody immobilization" , MI KROSYSTEMTECHNIK - KONGRESS 2013 , AACHEN , GERMANY, 14-16 OCT. 2013 ; POSTER 1.13 , 15 October 2013 (2013-10-15) , pages 384-387 , XP055093601 , http://www.imtek.de/data/1_ehrstuehle/app/dokumente/conferences-pdf/conferences-2013/vashi-st-rapid-immunodiagnostics-kits the whole document	1-19 ,26

INTERNATIONAL SEARCH REPORT

International application No.
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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

I-19 (completely) ; 26(partially)

Remark on Protest

The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-19 (completely) ; 26(partially)

Method of covalent immobilization of a biomolecule

2. claims: 20-23

Solid material obtainable by the method of invention 1

3. claim: 24

Kit suitable for use in the method of invention 1.

4. claims: 25, 27-29 (completely) ; 26(partially)

Immunoassay

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2013/070919

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
us 2005079486	AI 14-04-2005	AT AU AU CA DE EP JP JP US Wo	383577 T 2004316165 AI 2009200609 AI 2539436 AI 602004011244 T2 1668366 A2 4668911 B2 2007506982 A 2005079486 AI 2005080983 A2	T AI AI AI T2 A2 B2 A AI A2	15-01-2008 01-09-2005 05-03-2009 01-09-2005 12-02-2009 14-06-2006 13-04-2011 22-03-2007 14-04-2005 01-09-2005
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Wo 2010044083	A2 22-04-2010	I E wo	20090797 AI 2010044083 A2	AI A2	23-06-2010 22-04-2010
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EP 1365249	AI 26-11-2003	EP JP US wo	1365249 AI 3922454 B2 2002155481 AI 02063310 AI	AI B2 AI AI	26-11-2003 30-05-2007 24-10-2002 15-08-2002
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