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Published:

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20 March 2014

(54) Title: ELECTROCHEMICAL TEMPERATURE MEASUREMENT AND SENSOR

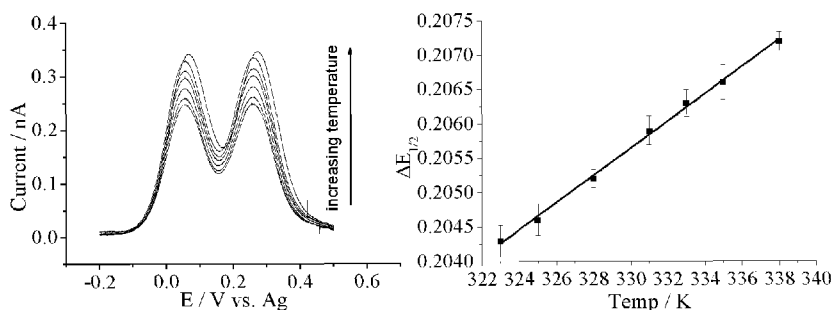


Fig. 2

(57) Abstract: An electrochemical method for measuring temperature, the method comprising • determining, at a temperature of interest, a first potential at which a first electrochemical reaction of a species occurs, • determining, at the temperature of interest, a second potential at which a second electrochemical reaction of the species occurs, • determining the difference between the first and second potentials, • converting the difference between the first and second potentials to a value of temperature. • Further provided is a temperature sensor for carrying out the method.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/050649

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01N27/48 G01K7/26
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)
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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	ANGEL A.J. TORRIERO ET AL: "Ionic liquid effects on the redox potential of ferrocene", ELECTROCHEMISTRY COMMUNICATIONS, vol. 16, no. 1, 15 December 2011 (2011-12-15), pages 84-87, XP055086000, ISSN: 1388-2481, DOI: 10.1016/j.elecom.2011.12.006 the whole document ----- -/--	1-29

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 29 January 2014	Date of mailing of the international search report 04/02/2014
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 Klein, Marc-Oliver

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/050649

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MITSURU MATSUMOTO ET AL: "The Decamethylferrocene(+/-) Electrode Reaction in Organic Solvents at Variable Pressure and Temperature", INORGANIC CHEMISTRY, vol. 43, no. 8, 18 March 2004 (2004-03-18), pages 2724-2735, XP055086046, ISSN: 0020-1669, DOI: 10.1021/ic030326j	25-28
A	the whole document	1-24,29
A	DE 10 2010 040146 A1 (BOSCH GMBH ROBERT [DE]) 8 March 2012 (2012-03-08) the whole document	1
T	LINHONGJIA XIONG ET AL: "An electrochemical thermometer: voltammetric measurement of temperature and its application to amperometric gas sensing", THE ANALYST, vol. 137, no. 11, 10 April 2012 (2012-04-10), pages 2567-2573, XP055085577, ISSN: 0003-2654, DOI: 10.1039/c2an35336a the whole document	
T	LINHONGJIA XIONG ET AL: "A simultaneous voltammetric temperature and humidity sensor", THE ANALYST, vol. 137, no. 21, 13 September 2012 (2012-09-13), pages 4951-4957, XP055085575, ISSN: 0003-2654, DOI: 10.1039/c2an35939a the whole document	
T	MENGDI ZHANG ET AL: "A hydrogel modified electrode for application as a voltammetric temperature sensor and its use in oxygen detection", ANALYTICAL METHODS, vol. 5, no. 14, 21 July 2013 (2013-07-21), page 3473, XP055085581, ISSN: 1759-9660, DOI: 10.1039/c3ay40741a the whole document	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2013/050649

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.:

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: 1-24

Electrochemical method for measuring temperature and temperature sensor

2. claims: 25-29

Electrochemical sensor for determining a species.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2013/050649

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102010040146 A1	08-03-2012	DE 102010040146 A1	08-03-2012
		EP 2612137 A1	10-07-2013
		US 2013220834 A1	29-08-2013
		WO 2012028380 A1	08-03-2012
