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(71) Applicant *(for all designated States except US)*: **BROWN UNIVERSITY** [US/US]; Horace Mann Building, 47 George Street, 3rd floor, Providence, Rhode Island 02912 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **FERNANDES, Gustavo E.** [BR/US]; 68 Preston St., Apt. 2R, Providence, Rhode Island 02912 (US). **XU, Jingming** [CA/US]; 310 Grotto Ave, Providence, Rhode Island 02906 (US). **KIM, Jin Ho** [KR/US]; 41 Cedar Pond Dr, Apt 6, Warwick, Rhode Island 02886 (US).

(74) Agents: **GUTERMAN, Sonia K.** et al.; Lawson & Weitzen, 88 Black Falcon Avenue, Suite 345, Boston, Massachusetts 02210 (US).

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Published:

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

[Continued on next page]

(54) Title: DEVICE AND METHODS FOR TEMPERATURE AND HUMIDITY MEASUREMENTS USING A NANOCOMPOSITE FILM SENSOR

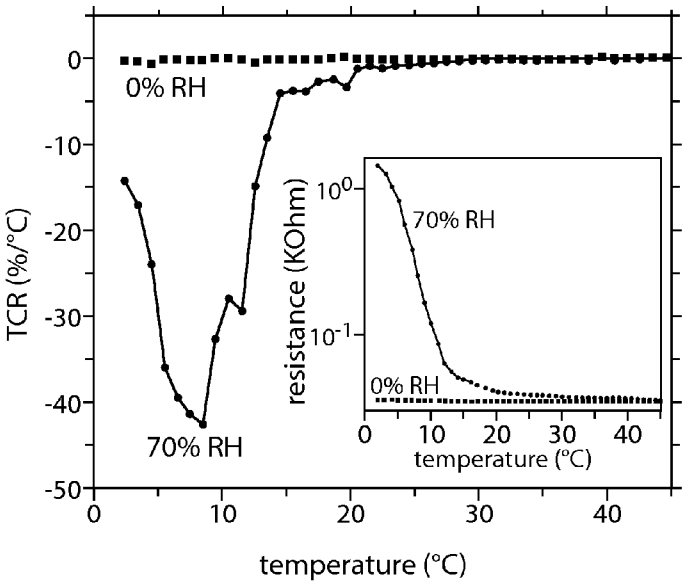

Figure 8B

(57) Abstract: Devices and methods are provided for a nanocomposite having a phase change polymer matrix and conductive nanoparticles to provide greatly enhanced responsivity to temperature and/or humidity. A sensing film includes carbon nanotubes (CNTs) and the polymer. Operation near the transition temperature increases the TCR by over an order of magnitude, thus providing a new platform for devices such as IR sensors, bolometers and imaging elements, MEMS devices, compensating or uncompensated circuit elements and other electronic devices. Nanocomposite films may be under about one micron thick, and coatings, constant environment chambers or mounts, and other engineered improvements and variations may be provided to further enhance the response, range, response times or sensitivity of the film-based devices. One embodiment employs a nanocomposite film under one micron in thickness to operate as an uncooled but highly sensitive infrared bolometer under ambient conditions.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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10 May 2013

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see Notice of 21 February 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/043829

A. CLASSIFICATION OF SUBJECT MATTER

G01N 27/12(2006.01)i

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 27/12; G01N 21/78; H01C 7/02; B82B 3/00; H01B 1/12; B82Y 30/00; B05D 1/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: phase, transition, polymer, conductive, nanoparticle, temperature, humidity, and sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003-0153088 A1 (DIMEO, JR. et al.) 14 August 2003 See paragraphs [0171], [0119], claim 1, and figure 5.	1-7,10-22
A	ZHAO, XIULI et al. `A KIND OF SMART GOLD NANOPARTICLE-HYDROGEL COMPOSITE WIT H TUNABLE THERMO-SWITCHABLE ELECTRICAL PROPERTIES`, NEW JOURNAL OF CHEMISTRY , pp 915-920, 11 APRIL 2006 See abstract, 4th paragraph in page 919 and scheme 1.	1-7,10-22
A	KR 10-2009-0103491 A (LEE, K.C.) 01 OCTOBER 2009 See claims 1,2,3 and paragraph [0071].	1-7,10-22
A	US 2006-0231970 A (HUANG et al.) 19 OCTOBER 2006 See claims 1 and 6.	1-7,10-22
A	US 2006-0043343 A1 (CHACKO, ANTONY P.) 2 MARCH 2006 See claim 1.	1-7,10-22

☐ 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 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
26 FEBRUARY 2013 (26.02.2013)	**27 FEBRUARY 2013 (27.02.2013)**

Name and mailing address of the ISA/KR

Facsimile No. 82-42-472-7140

Authorized officer

PARK, Jin Ho

Telephone No. 0424818398

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/043829

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.: 9
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:

Claim 9 refers to claim 8 which is unsearchable.

3. ☒ Claims Nos.: 8
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:

1. ☐ As all required addtional 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 fee, this Authority did not invite payment of any additional fee.

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/043829

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