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(54) Title: MULTI-RESPONSE SINGLE LAYER SENSOR PLATFORM

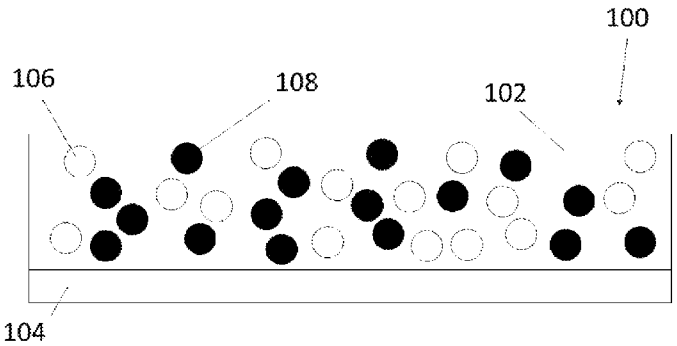

FIG. 1

(57) Abstract: An apparatus, system, and method for producing a temperature exposure indicator is disclosed. The temperature exposure indicator includes a substrate and a mixture containing a first thermochromic material and a second thermochromic material. Each thermochromic material has an initial color state when the mixture is in a base temperature range and each thermochromic material is configured to change to an excursion color state at a certain temperature threshold. As a result, the mixture displays a low mixture excursion color state below a low temperature threshold and a high mixture excursion color state above a high temperature threshold.

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[Continued on next page]

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 24/16680

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. C09D 5/26, C09D 11/50, B41M 5/28 (2024.01)
ADD. C09D 11/037 (2024.01)

CPC - INV. C09D 5/26, C09D 11/50, B41M 5/28
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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)
See Search History document

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2022/0057274 A1 (NBST CO., LTD.) 24 February 2022 (24.02.2022) entire document; especially para [0011]-[0018], para [0045]	1, 4-8, 10, 21-23 --- 2, 3, 9
Y	US 2022/0112391 A1 (TEMPTIME CORPORATION) 14 April 2022 (14.04.2022) entire document; especially para [0249]; para [0329]	2, 3
Y	US 2019/0382585 A1 (SOCIETE BIC) 19 December 2019 (19.12.2019) entire document; especially para [0047], para [0060]-[0062]	9

☐ 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
"D" document cited by the applicant in the international application
"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
17 June 2024	JUL 19 2024
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 24/16680

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:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-10, 21-23 are directed to a temperature exposure indicator and a method of producing.

Group II: Claims 11-15 are directed to a thermochromic ink.

Group III: Claims 16-20 are directed to an article of manufacture.

---see extra 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 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.:
1-10, 21-23

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

International application No.

PCT/US 24/16680

Continuation of Box No. III -- Observations where unity of invention is lacking

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:
Group I includes the special technical feature of a substrate, not included in the other groups.

Group II includes the special technical feature of a thermochromic ink, not included in the other groups.

Group III includes the special technical feature of a package, not included in the other groups.

Common Technical Features:
The only technical feature shared by Groups I-III that would otherwise unify the groups a first thermochromic material and a second thermochromic material. However, this shared technical feature does not represent a contribution over the prior art, because the shared technical feature is disclosed by US 2022/0057274 A1 to NBST Co., Ltd. (hereinafter "NBST").

The only additional technical feature shared by Groups I and III that would otherwise unify the groups a temperature exposure indicator having a mixture of a first thermochromic material and a second thermochromic material, the first thermochromic material having a first initial color state while in a base temperature range and configured to change to a low excursion color state below a low temperature threshold, the second thermochromic material having a second initial color state while in the base temperature range and configured to change to a high excursion color state above a high temperature threshold, and the mixture configured to have a base mixture color state in the base temperature range, a low mixture excursion color state below the low temperature threshold, and a high mixture excursion color state above the high temperature threshold. However, this shared technical feature does not represent a contribution over the prior art, because the shared technical feature is disclosed by NBST.

NBST discloses a temperature exposure indicator(para [0018]- The thermochromic ink composition mixed layer included in the patch-type thermometer of the present invention may exhibit different colors depending on the temperature) having a mixture of a first thermochromic material and a second thermochromic material (para [0011]- composed of a thermochromic ink composition including first thermochromic ink powder exhibiting a first color, second thermochromic ink powder exhibiting a second color, third thermochromic ink powder exhibiting a third color), the first thermochromic material having a first initial color state while in a base temperature range and configured to change to a low excursion color state below a low temperature threshold (para [0045]- the third color is exhibited in the case of a low body temperature or before the thermometer is attached to a human body (lower than or equal to approximately 35 C.), a mixed color of the first and second colors is exhibited at approximately 35 C. to approximately below 37.5 C., which is a normal body temperature of a person, with the third color gradually disappearing), the second thermochromic material having a second initial color state while in the base temperature range and configured to change to a high excursion color state above a high temperature threshold (para [0045]- only the first color is exhibited with the second color gradually disappearing when the body temperature of a person becomes higher than or equal to approximately 37.5 C. due to high fever), and the mixture configured to have a base mixture color state in the base temperature range, a low mixture excursion color state below the low temperature threshold, and a high mixture excursion color state above the high temperature threshold (para [0045]- the third color is exhibited in the case of a low body temperature or before the thermometer is attached to a human body (lower than or equal to approximately 35 C.), a mixed color of the first and second colors is exhibited at approximately 35 C. to approximately below 37.5 C., which is a normal body temperature of a person, with the third color gradually disappearing, and only the first color is exhibited with the second color gradually disappearing when the body temperature of a person becomes higher than or equal to approximately 37.5 C. due to high fever).

Accordingly, the inventions listed as Groups above lack unity of invention under PCT Rule 13 because the do not share a same or corresponding special technical feature providing contribution over prior art.