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H01M 2/06 (2006.01)

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- with international search report (Art. 21(3))
- 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))

(88) Date of publication of the international search report:

3 November 2016

(54) Title: CERAMIC MATERIALS AND SEALS FOR HIGH TEMPERATURE REACTIVE MATERIAL DEVICES

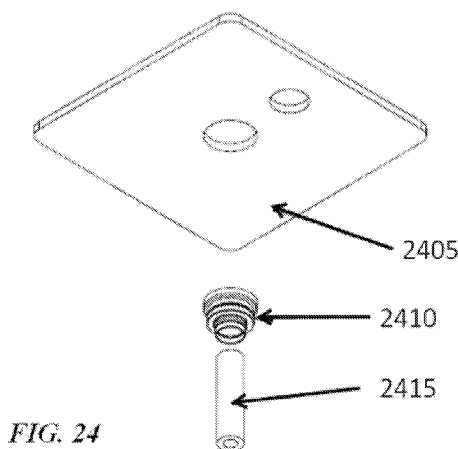


FIG. 24

(57) Abstract: The disclosure provides seals for devices that operate at elevated temperatures and have reactive metal vapors, such as lithium, sodium or magnesium. In some examples, such devices include energy storage devices that may be used within an electrical power grid or as part of a standalone system. The energy storage devices may be charged from an electricity production source for later discharge, such as when there is a demand for electrical energy consumption.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/021048**A. CLASSIFICATION OF SUBJECT MATTER****H01M 10/39(2006.01)I, H01M 2/06(2006.01)I, H01M 2/08(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)

H01M 10/39; H01L 21/3065; B32B 15/04; C04B 35/56; B23K 31/12; C03L 14/00; C04B 35/565; C04B 35/48; F41H 5/02; H01M 2/06; H01M 2/08

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: ceramic material, seal, neodymium oxide, aluminum nitride, electrochemical cell, ballistic armor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7055733 B2 (WEIL, K. SCOTT et al.) 6 June 2006 See claim 1; column 9, lines 44-45.	1-52, 106-114
X	US 2008-0264565 A1 (SUN, JENNIFER Y. et al.) 30 October 2008 See claims 1, 6; table 4; paragraphs [0061], [0063].	53-55, 58-67 , 115-116
A		56-57, 68-69, 71-87
A	US 6579817 B2 (HARADA, KENJI et al.) 17 June 2003 See claims 1, 3, 6.	53-69, 71-87 , 115-116
X	WO 2008-105807 A2 (DYNAMIC DEFENSE MATERIALS, LLC) 4 September 2008 See claims 1, 11; paragraph [0016].	88-92, 94-98 , 100-105, 117-120
A		93, 99
A	US 2010-0240517 A1 (ASHKIN, DANIEL et al.) 23 September 2010 See claims 1, 21-22.	88-105, 117-120



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

07 September 2016 (07.09.2016)

Date of mailing of the international search report

07 September 2016 (07.09.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

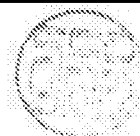
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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US2016/021048**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

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.: 70
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:

- Group 1: Claims 1-52 and 106-114 relate to an electrochemical cell comprising a container and a seal, wherein the seal comprises a ceramic component.
- Group 2: Claims 53-69, 71-87 and 115-116 relate to a ceramic material comprising neodymium oxide.
- Group 3: Claims 88-105 and 117-120 relate to a ceramic material comprising aluminum nitride and at least one of silicon carbide and titanium carbide.

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 any 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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/021048

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/021048

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