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H01M 8/18 (2006.01) *H01M 8/1053* (2016.01)
H01M 8/0239 (2016.01) *H01M 8/1058* (2016.01)
H01M 8/0245 (2016.01) *H01M 8/1088* (2016.01)
H01M 8/1032 (2016.01)

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(81) Designated States (*unless otherwise indicated, for every*

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: BIPOLAR IONOMER MEMBRANE

(57) Abstract: Provided are membranes useful for electrochemical or fuel cells. A membrane may be formed of or include a sulfonated polymer whereby the sulfonated polymer is covalently or ionically associated with a multi-nitrogen containing heterocyclic molecule. The resulting membranes possess excellent ion conductivity and selectivity.

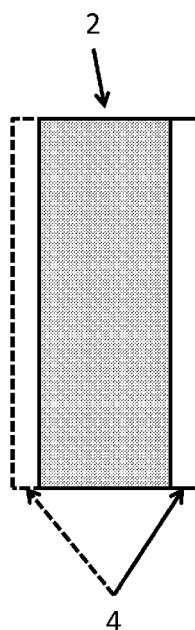


FIG. 1



Published:

- *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))*

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A. CLASSIFICATION OF SUBJECT MATTER

C08J 5/22(2006.01)i, H01M 8/18(2006.01)i, H01M 8/0239(2016.01)i, H01M 8/0245(2016.01)i, H01M 8/1032(2016.01)i, H01M 8/1011(2016.01)i, H01M 8/1053(2016.01)i, H01M 8/1058(2016.01)i, H01M 8/1088(2016.01)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)

C08J 5/22; H01M 2/16; H01M 8/02; H01M 8/10; H01M 8/18; H01M 8/0239; H01M 8/0245; H01M 8/1032; H01M 8/1011; H01M 8/1053; H01M 8/1058; H01M 8/1088

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: membrane, functionalization, sulfonated polymer, heterocyclic molecule, vanadium redox flow battery, fuel cell, porous support

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008-0020256 A1 (MANTHIRAM, ARUMUGAM et al.) 24 January 2008 See paragraphs [0005]-[0012], [0056]-[0105]; and claims 1, 11.	1-53
Y	LIU, SHUAI et al., "Novel sulfonated poly (ether ether keton)/polyetherimide acid-base blend membranes for vanadium redox flow battery applications", 2014, Electrochimica Acta, Vol. 130, pages 90-96 See abstract; pages 91, 92, 95, 96; and figure 1.	1-53
Y	KR 10-2013-0112976 A (KOLON INDUSTRIES, INC.) 15 October 2013 See paragraphs [0001], [0013]-[0045], [0085]-[0092], [0161], [0162], [0183]-[0190]; and claims 1-15.	10-13, 19-21, 30-32, 43, 44, 48-53
A	US 2009-0297910 A1 (ZHU, XIAOBING et al.) 03 December 2009 See paragraphs [0022]-[0038]; and claims 1-25.	1-53
A	US 2011-0318644 A1 (ZHAI, MAOLIN et al.) 29 December 2011 See paragraphs [0022]-[0033]; and claims 1-19.	1-53
L	International application No. PCT/US2017/016466 Applicant : CAMX POWER, L.L.C International filing date : 03 February 2017 Priority date : 03 February 2016	1-53

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

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"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

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"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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008-0020256 A1	24/01/2008	US 8288025 B2	16/10/2012
KR 10-2013-0112976 A	15/10/2013	KR 10-1666887 B1	18/10/2016
US 2009-0297910 A1	03/12/2009	JP 2010-045018 A JP 5610708 B2 US 8586259 B2	25/02/2010 22/10/2014 19/11/2013
US 2011-0318644 A1	29/12/2011	None	