

(19)



(11)

EP 4 455 371 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
07.05.2025 Bulletin 2025/19

(43) Date of publication A2:
30.10.2024 Bulletin 2024/44

(21) Application number: **24163202.5**

(22) Date of filing: **13.03.2024**

(51) International Patent Classification (IPC):
C25B 13/08 ^(2006.01) **C25B 13/05** ^(2021.01)
C25B 1/04 ^(2021.01) **C25B 1/23** ^(2021.01)
C25B 3/03 ^(2021.01) **C25B 3/26** ^(2021.01)
C25B 9/23 ^(2021.01) **C25B 11/031** ^(2021.01)
C25B 11/032 ^(2021.01) **C25B 11/063** ^(2021.01)
C25B 11/065 ^(2021.01) **C25B 11/091** ^(2021.01)

(52) Cooperative Patent Classification (CPC):
C25B 13/08; C25B 1/04; C25B 1/23; C25B 3/03;
C25B 3/26; C25B 9/23; C25B 11/031;
C25B 11/032; C25B 11/063; C25B 11/065;
C25B 11/091; C25B 13/05

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **26.04.2023 JP 2023072196**
06.02.2024 JP 2024016578

(71) Applicant: **Kabushiki Kaisha Toshiba**
Tokyo 105-0023 (JP)

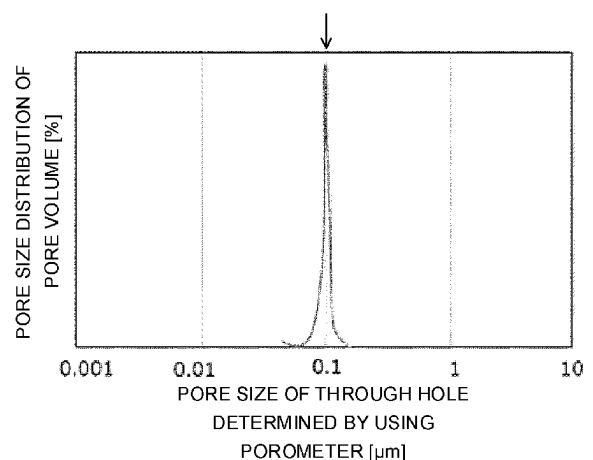
(72) Inventors:
• **YONETSU, Maki**
Tokyo, 105-0023 (JP)
• **KIYOTA, Yasuhiro**
Tokyo, 105-0023 (JP)
• **KOFUJI, Yusuke**
Tokyo, 105-0023 (JP)
• **KITAGAWA, Ryota**
Tokyo, 105-0023 (JP)
• **MIKOSHIBA, Satoshi**
Tokyo, 105-0023 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) ELECTROLYSIS CELL AND ELECTROLYSIS DEVICE

(57) An electrolysis cell 20 includes: a cathode 31 to reduce a reducible gas; an anode 41 to oxidize an oxidizable substance in an electrolytic solution, the cathode 41 containing titanium; and a separator 50 separating the cathode 31 from the anode 41. The separator 50 includes a porous membrane. The porous membrane gives a pore size distribution defined by a graph having a horizontal axis and a vertical axis, the horizontal axis representing pore sizes of through holes of the porous membrane, the pore sizes being determined by using a porometer, the vertical axis representing a pore size flow distribution of pore volumes corresponding to the pore sizes, and the pore size distribution having a peak top in a range of not less than 0.01 μm nor more than 0.3 μm . The porous membrane has an ISO air permeance of not less than 0.8 $\mu\text{m/Pa}\cdot\text{s}$ nor more than 150 $\mu\text{m/Pa}\cdot\text{s}$.

FIG. 2





EUROPEAN SEARCH REPORT

Application Number

EP 24 16 3202

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 4 060 088 A2 (TOSHIBA KK [JP]) 21 September 2022 (2022-09-21) * paragraphs [0006], [0020], [0040], [0049], [0062] - [0066], [0069] - [0073]; figures; example 1 *	1-15	INV. C25B13/08 C25B13/05 C25B1/04 C25B1/23 C25B3/03
X	EP 4 060 087 A1 (TOSHIBA KK [JP]) 21 September 2022 (2022-09-21) * paragraphs [0068], [0070], [0072]; figures *	1-15	C25B3/26 C25B9/23 C25B11/031 C25B11/032 C25B11/063
X	WO 2023/038116 A1 (ASAHI CHEMICAL IND [JP]) 16 March 2023 (2023-03-16) * paragraphs [0040], [0056] *	1-15	C25B11/065 C25B11/091
X	EP 3 460 103 A1 (TOSHIBA KK [JP]) 27 March 2019 (2019-03-27) * paragraphs [0089], [0106] *	1-15	
A	WO 2020/132064 A1 (OPUS 12 INC [US]) 25 June 2020 (2020-06-25) * paragraphs [0128], [0142], [0157], [0231], [0235] *	1-15	TECHNICAL FIELDS SEARCHED (IPC)
A	XIN LE ET AL: "Polybenzimidazole (PBI) Functionalized Nanographene as Highly Stable Catalyst Support for Polymer Electrolyte Membrane Fuel Cells (PEMFCs)", JOURNAL OF THE ELECTROCHEMICAL SOCIETY, vol. 163, no. 10, 1 January 2016 (2016-01-01), pages F1228-F1236, XP093264078, ISSN: 0013-4651, DOI: 10.1149/2.0921610jes * figure 4 *	1-15	C25B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 April 2025	Examiner Ulivieri, Enrico
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 16 3202

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

01-04-2025

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 4060088	A2	21-09-2022	AU	2022201214 A1		06-10-2022
			CN	115110103 A		27-09-2022
			EP	4060088 A2		21-09-2022
			JP	7413304 B2		15-01-2024
			JP	2022143994 A		03-10-2022
			US	2022298660 A1		22-09-2022

EP 4060087	A1	21-09-2022	EP	4060087 A1		21-09-2022
			EP	4234763 A2		30-08-2023
			JP	7524118 B2		29-07-2024
			JP	2022143970 A		03-10-2022
			US	2022298655 A1		22-09-2022

WO 2023038116	A1	16-03-2023	NONE			

EP 3460103	A1	27-03-2019	EP	3460103 A1		27-03-2019
			JP	2019056136 A		11-04-2019
			US	2019085470 A1		21-03-2019

WO 2020132064	A1	25-06-2020	AU	2019401616 A1		22-07-2021
			BR	112021011768 A2		31-08-2021
			CA	3123592 A1		25-06-2020
			CN	113614287 A		05-11-2021
			CN	119121255 A		13-12-2024
			EP	3899092 A1		27-10-2021
			JP	2022513860 A		09-02-2022
			JP	2024167174 A		03-12-2024
			KR	20210131999 A		03-11-2021
			SA	521422291 B1		29-02-2024
			US	2020220185 A1		09-07-2020
			US	2022393203 A1		08-12-2022
			US	2024145745 A1		02-05-2024
			WO	2020132064 A1		25-06-2020

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82