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(54) Title: POROUS MATERIAL WITH MICROSCALE FEATURES

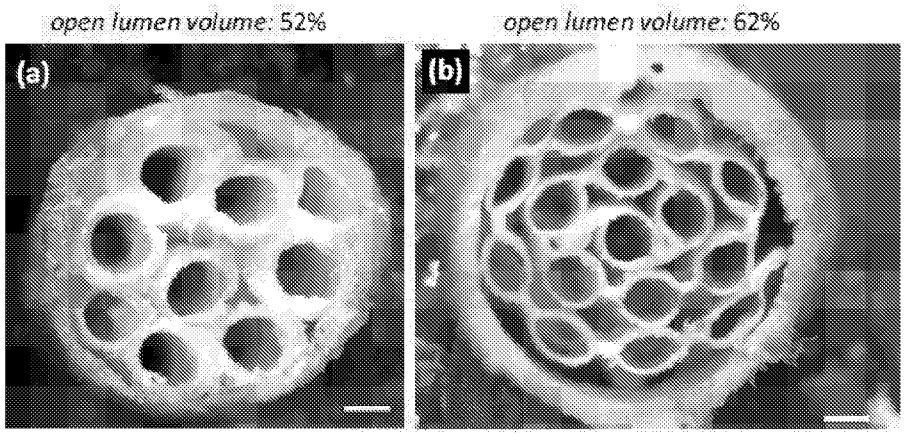

FIG. 4

(57) Abstract: Provided herein is technology relating to materials having microscale and/or nanoscale features and particularly, but not exclusively, to porous materials comprising microscale features, methods for producing porous materials comprising microscale features, drug delivery vehicles, and related kits, systems, and uses.

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[Continued on next page]

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 20/12966

A. CLASSIFICATION OF SUBJECT MATTER

IPC - A61L 27/56; B29C 59/02; C08J 5/18 (2020.01)

CPC - A61F 2/0077; A61F 2002/30838; A61L 27/56; A61L 31/146; B29C 2043/025; B29C 2059/023; B81C 2201/0147; B29K 2105/04; C08J 5/18; Y10T 428/249953; Y10S 502/52724

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	US 2016/0167291 A1 (W.L. Gore & Associates GmbH) 16 June 2016 (16.06.2016); entire document, but especially: para [0001], para [0021], para [0025], para [0043], para [0077], para [0204], para [0205], para [0210], table 3	1, 3, 7, 13-14
X	Zhang et al. "Poly(lactide-co-glycolide)/Hydroxyapatite Porous Scaffold with Microchannels for Bone Regeneration" Polymers, Vol 8 Issue 6 (07 June 2016): pages 1-11; entire document, but especially: abstract, page 2 para 5, page 5 para 2	1-6
X	US 2016/0013461 A1 (Toray Battery Separator Film Co., Ltd.) 14 January 2016 (14.01.2016); para [0026], para [0045], para [0110], para [0111]	1, 3, 8-11
X --- Y	US 5,948,020 A (Yoon et al.) 07 September 1999 (07.09.1999); entire document, but especially: col 3 lines 12-14, col 4 lines 1-5, col 4 lines 22-23, col 4 lines 37-40, col 5 lines 17-23, col 9 lines 52-54, example 3	1, 3-6, 12-13 ---------- 61-63
Y	US 2011/0300222 A1 (Sailor et al.) 08 December 2011 (08.12.2011); para [0005], para [0078]	61-63

☒ 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
09 March 2020 (09.03.2020)	01 JUL 2020
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 Lee Young Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 20/12966

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:
---See Supplemental 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.:
1-14 and 61-63

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 20/12966

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015/0270520 A1 (Celgard, LLC) 24 September 2015 (24.09.2015); entire document	1-14, 61-63
A	US 2017/0297292 A1 (Tredegar Film Products Corporation) 19 October 2017 (19.10.2017); entire document	1-14, 61-63
A	WO 2017/031524 A1 (The Australian National University) 02 March 2017 (02.03.2017); entire document	1-14, 61-63

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US 20/12966

Lack of Unity Invention

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 1-14 and 61-63 directed to a porous film material.

Group II: Claims 15-37 and 64-67 directed to a method for producing a porous film material and a porous film material produced by a method.

Group III: Claims 38-43 and 68-71 directed to a device comprising a rolled porous film material.

Group IV: Claims 44-47 directed to a use of a porous film material.

Group V: Claims 48-60 and 72-73 directed to a system for producing a porous film material.

The inventions listed as Groups I-V 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

The invention of Group II includes the special technical feature of a method for producing a porous film material comprising microscale features and a porosity of 60% vol or more, said method comprising: a) providing a polymer film and b) embossing said polymer film to produce said porous film material comprising microscale features, not required by the claims of Groups I or III-V.

The invention of Group III includes the special technical feature of a device comprising a rolled porous film material comprising microscale features and a porosity of 60 %vol or more, not required by the claims of Groups I-II or IV-V.

The invention of Group IV includes the special technical feature of a use of a porous film material comprising microscale features and a porosity of 60% vol or more as a catalyst, tissue scaffold, a biomedical device to support tissue growth, or to treat a subject in need of tissue repair or growth, not required by the claims of Groups I-III or V.

The invention of Group V includes the special technical feature of a system for producing a porous film material comprising microscale features and a porosity of 60% vol or more, said system comprising: a) a polymer film and b) an embossing block comprising microscale features, not required by the claims of Groups I-IV.

COMMON TECHNICAL FEATURES

Groups I-V share the common technical feature of a porous film material comprising microscale features and a porosity of 60% vol or more. However, this shared technical feature does not represent a contribution over prior art as being anticipated by US 2016/0167291 A1 to W.L. Gore & Associates GmbH, which discloses of a porous film material (para [0001]: "The present invention relates to a process for the formation of a structured porous film...") comprising microscale features and a porosity of 60% vol or more (para [0021]: "By 'structured film', a film is denoted which shows any kind of geometric out-of-plane structures, such as wrinkles..."; para [0077]: "The height of the structures in the porous film preferably is... more preferably 20 micro m to 1000 micro m"; Example 4C, para [0205]: "A monolithic ePTFE membrane was made... [t]he membrane had... a porosity of 88 percent..."; para [0210]: "The film of Example 4C was processed.... uniform winkle formation"; see table 3, example 4C (structured)).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical features that would otherwise unify the groups.

Therefore, Groups I-V lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.