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(54) Title: METHOD OF FORMING CERAMIC FLUIDIC MODULES WITH SMOOTH INTERIOR SURFACES AND MODULES PRODUCED

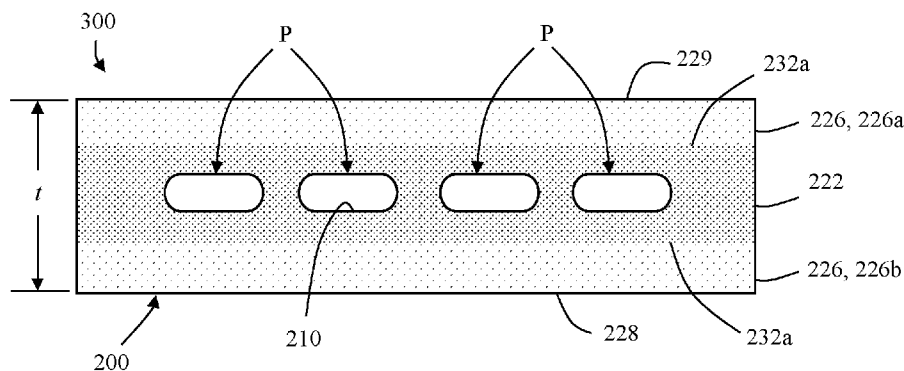


FIG. 4

(57) Abstract: A fluidic module includes a monolithic closed-porosity ceramic body that has a first region and a second region with the first region disposed between the second region. The first and second regions are configured to differ from one another with respect to a common attribute of a ceramic material of the ceramic body. The common attribute can differ by forming the first and second regions from ceramic particles that differ with respect their particle sizes. The fluidic module further includes a tortuous fluid passage that extends through the ceramic body. The fluid passage is surrounded by the first region such that the fluid passage is separated entirely from the second region at least within a planar region of the ceramic body. The fluid passage has an interior surface with a surface roughness of less than or equal to 5 μm Ra. A method for forming the fluidic module is disclosed.



SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,  
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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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:**

15 June 2023 (15.06.2023)

**INTERNATIONAL SEARCH REPORT**

International application No  
**PCT/US2022/048671**

**A. CLASSIFICATION OF SUBJECT MATTER**  
**INV. C04B35/565 B01J19/00 B28B7/18 B28B7/34 C04B35/626**  
**C04B35/638 C04B38/00 F28F7/02 B32B18/00**

**ADD.**  
 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)  
**F28F B01J B29C B28B C04B B32B**

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
**EPO-Internal, WPI Data**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
<b>A</b>	<b>WO 2021/067455 A1 (CORNING INC [US])</b> <b>8 April 2021 (2021-04-08)</b> <b>paragraphs [0044], [0045]; claims 1-30</b> -----	<b>1-38</b>
<b>A</b>	<b>US 2009/280299 A1 (FERRATO MARC [FR])</b> <b>12 November 2009 (2009-11-12)</b> <b>paragraphs [0028] - [0040]; figure 1</b> -----	<b>1-38</b>
<b>A</b>	<b>US 2010/322829 A1 (DENY PIERRE [FR])</b> <b>23 December 2010 (2010-12-23)</b> <b>claims 1-11</b> -----	<b>1-38</b>

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  
**14 March 2023**

Date of mailing of the international search report  
**12/05/2023**

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 European Patent Office, P.B. 5818 Patentlaan 2  
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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2022/048671

## 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 additional 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 an 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.:

**1-38**

### 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/US2022/048671**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
<b>WO 2021067455 A1</b>	<b>08-04-2021</b>	<b>CN 114728854 A</b>	<b>08-07-2022</b>
		<b>EP 4038036 A1</b>	<b>10-08-2022</b>
		<b>JP 2022550186 A</b>	<b>30-11-2022</b>
		<b>KR 20220070225 A</b>	<b>30-05-2022</b>
		<b>US 2022401952 A1</b>	<b>22-12-2022</b>
		<b>WO 2021067455 A1</b>	<b>08-04-2021</b>
		<b>WO 2021067459 A1</b>	<b>08-04-2021</b>
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<b>US 2009280299 A1</b>	<b>12-11-2009</b>	<b>AT 456416 T</b>	<b>15-02-2010</b>
		<b>EP 2066474 A1</b>	<b>10-06-2009</b>
		<b>ES 2339407 T3</b>	<b>19-05-2010</b>
		<b>FR 2905754 A1</b>	<b>14-03-2008</b>
		<b>US 2009280299 A1</b>	<b>12-11-2009</b>
		<b>WO 2008031966 A1</b>	<b>20-03-2008</b>
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<b>US 2010322829 A1</b>	<b>23-12-2010</b>	<b>CN 101646634 A</b>	<b>10-02-2010</b>
		<b>EP 2125665 A2</b>	<b>02-12-2009</b>
		<b>FR 2913109 A1</b>	<b>29-08-2008</b>
		<b>JP 2010519502 A</b>	<b>03-06-2010</b>
		<b>KR 20100014841 A</b>	<b>11-02-2010</b>
		<b>US 2010322829 A1</b>	<b>23-12-2010</b>
		<b>WO 2008119900 A2</b>	<b>09-10-2008</b>
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-38

A method of forming a ceramic fluidic module for a flow reactor

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2. claims: 39-58

A fluidic module

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