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[Continued on next page]

(54) Title: HIGHLY POROUS CERAMIC MATERIAL AND METHOD OF USE AND FORMING SAME

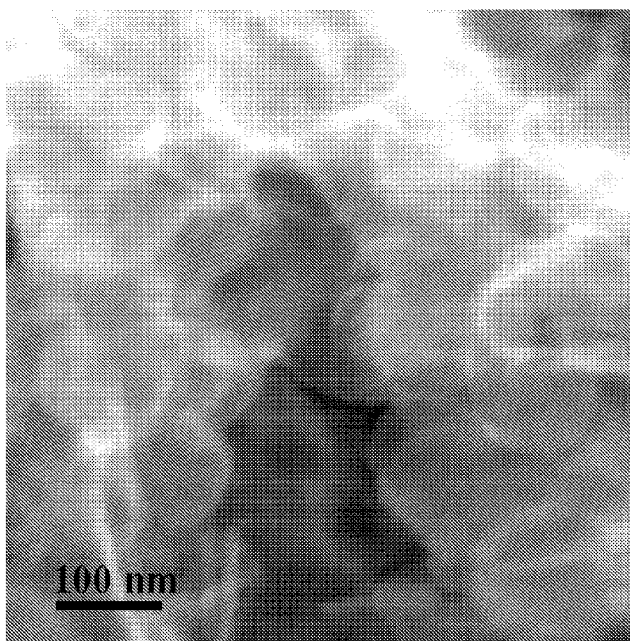


FIG. 1

(57) Abstract: The present invention generally relates to porous ceramic material and to methods of making and using the material. More particularly, the invention relates to methods of forming ceramic materials by depositing material, using atomic layer deposition, onto a sacrificial substrate and to ceramic materials having controlled wall thickness, relatively large pores, and high surface area by weight.





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10 January 2013

- *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))*

**A. CLASSIFICATION OF SUBJECT MATTER*****B28B 1/50(2006.01)i, C04B 38/00(2006.01)i, C04B 41/81(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)

B28B 1/50; C01B 39/00; B32B 3/02; C01B 39/04; C23C 16/02

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) &amp; Keywords: porous, ceramic, sacrificial substrate, ALD, alumina, titanium oxide

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	CHIH-CHIEH WANG et al., Nano Letters, Vol.7, 2007, pp1566-1569. See abstract and page 1568.	1-5 14 13, 15, 16, 20, 21
X Y	XINHUA LIANG et al., Chem. Mater., Vol.19, 2007, pp5388-5394. See pages 5389-5392.	13, 20, 21 14-16
Y	US 2006-0088470 A1 (ANDERS LARSSON et al.) 27 April 2006. See claims and paragraph [0010].	15, 16
A	US 2010-0178468 A1 (JIANG YING-BING et al.) 15 July 2010. See the entire document.	1-5, 13-16, 20, 21
PX	XINHUA LIANG et al., Microporous and Mesoporous Materials, Vol.149, 25 August 2012, pp106-110. See experimental section.	1-5, 13-16, 20, 21

 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

15 NOVEMBER 2012 (15.11.2012)

Date of mailing of the international search report

**16 NOVEMBER 2012 (16.11.2012)**

Name and mailing address of the ISA/KR

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**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.: 6-12,17-19  
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 1-5 relate to a method of forming a porous ceramic material comprising a variety of steps.

Group 2: Claims 13-16 and 20-21 relate to a porous ceramic material characterized with its pore volume and surface area.

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 fee, this Authority did not invite payment of any additional fee.
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/US2012/032028**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0088470 A1	27.04.2006	EP 1594817 A1	16.11.2005
		SE 0300482 D0	21.02.2003
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