

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 November 2007 (01.11.2007)

PCT

(10) International Publication Number
WO 2007/123725 A3

(51) International Patent Classification:
B28B 3/20 (2006.01) **C04B 35/634** (2006.01)
C04B 35/622 (2006.01)

(21) International Application Number:
PCT/US2007/007968

(22) International Filing Date: 30 March 2007 (30.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/788,586 31 March 2006 (31.03.2006) US
11/433,838 12 May 2006 (12.05.2006) US

(71) Applicant (for all designated States except US): **MASSACHUSETTS INSTITUTE OF TECHNOLOGY** [US/US]; 77 Massachusetts Avenue, Cambridge, MA 02139 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SACHS, Emanuel** [US/US]; 18 Moreland Avenue, Newton, MA 02159 (US). **NAIMAN, Alaric** [US/US]; 12 Huntley Lane, Lincoln, MA 01773 (US). **SERDY, James** [US/US]; 222 Marlborough Street, Boston, MA 02116 (US).

(74) Agent: **OYER, Timothy, J.**; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).

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

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
19 June 2008



WO 2007/123725 A3

(54) Title: CERAMIC PROCESSING AND SHAPED CERAMIC BODIES

(57) Abstract: The present invention relates to methods for the formation of ceramic bodies. Methods of the invention involve processing ceramic-forming compositions to form an integrally self-supporting or stabilized structure, which may then be sintered to give the full-density ceramic product. Methods of the invention may also involve densification of the ceramic body. In one set of embodiments, the volume of the integrally self-supporting structure is reduced by at least 20%. The present invention may produce ceramic bodies having greater strength and durability, since the ceramic-forming compositions may be low in viscosity and may be homogeneously blended, decreasing the possibility for defects.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/007968

A. CLASSIFICATION OF SUBJECT MATTER
INV. B28B3/20 C04B35/622 C04B35/634

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)
C04B

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 practical, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 312 670 A (COLUCCI STEPHEN L) 26 January 1982 (1982-01-26) Col. 6, line 45 to Col. 8, line 38;claims 1,11	1-6,8,9, 11-13,15
X	WO 99/10294 A (CORNING INC [US]) 4 March 1999 (1999-03-04) Example on table 1; Page 25, line 16 to page 26, line 8; Claims 1 and 10.	1-3, 9-13,15

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 document 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

21 September 2007

Date of mailing of the international search report

06/05/2008

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Vathilakis, S

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/007968

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	NATH DAS R ET AL: "Rheological studies on cordierite honeycomb extrusion" JOURNAL OF THE EUROPEAN CERAMIC SOCIETY, ELSEVIER SCIENCE PUBLISHERS, BARKING, ESSEX, GB, vol. 22, no. 16, December 2002 (2002-12), pages 2893-2900, XP004387508 ISSN: 0955-2219 Abstract; Sections 2 "Experimental " and 3 "Results and discussion" -----	1-15
A	US 6 689 184 B1 (MORRIS ROBERT CRAIG [US]) 10 February 2004 (2004-02-10) claims 1,2,23; examples 1,2,and -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/007968

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.: 16-47
because they relate to subject matter not required to be searched by this Authority, namely:
see FURTHER INFORMATION sheet PCT/ISA/210
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 allsearchable 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.:

1-15

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Continuation of Box II.1

Claims Nos.: 16-47

Lack of unity.

According to Art. 17(3) (a) PCT the International Search Report was established on those parts of the International Application which relate to the invention first mentioned in the claims, i.e the above mentioned group 1, claims 1-15.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-15

A method for making a ceramic structure by means of extrusion including a step of rapidly modifying the reology of the extrudate.

2. claims: claims 16-38

A method for making a ceramic structure, comprising a fluidic ceramic precursor composition comprising a ceramic-forming powder with a solid loading of less than 55 vol.%, wherein the composition has a viscosity of less than 100000 cP.

3. claims: 39-45

A method for making a ceramic structure by means of extrusion of a ceramic precursor composition comprising a ceramic-forming powder and at least a fluid carrier, whereby at least a portion of the fluid carrier is removed such that the structure is reduced in volume by at least 20%.

4. claim: 46

A method for making a ceramic structure, comprising a fluidic ceramic precursor composition comprising a ceramic-forming powder, whereby the composition has a solid loading of less than 55% by volume.

5. claim: 47

A method for making a ceramic structure, comprising a fluidic ceramic precursor composition comprising a ceramic-forming powder, whereby the composition has viscosity of less than 100000cP.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2007/007968
--

Patent document cited in search report	A	Publication date		Patent family member(s)	Publication date
US 4312670	A	26-01-1982	DE	3103008 A1	24-12-1981
			GB	2068049 A	05-08-1981
			JP	56123412 A	28-09-1981
<hr/>					
WO 9910294	A	04-03-1999	AT	232512 T	15-02-2003
			AU	8687298 A	16-03-1999
			CN	1261867 A	02-08-2000
			DE	69811381 D1	20-03-2003
			EP	1021387 A1	26-07-2000
			JP	2001514099 T	11-09-2001
<hr/>					
US 6689184	B1	10-02-2004	AU	2003245567 A1	09-02-2004
			WO	2004009858 A1	29-01-2004
			US	2004013557 A1	22-01-2004