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60/906,464 12 March 2007 (12.03.2007) US
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, 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, ME, 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.
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(54) **Title:** HIGH STRENGTH CERAMIC ELEMENTS AND METHODS FOR MAKING AND USING THE SAME

(57) **Abstract:** One embodiment of the present invention relates to spherical ceramic elements, such as proppants, for maintaining permeability in subterranean formations to facilitate extraction of oil and gas therefrom. The strength of the ceramic element may be enhanced by combining materials having different coefficients of thermal expansion. Methods of making the ceramic elements are also disclosed.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/003295

A. CLASSIFICATION OF SUBJECT MATTER
 INV. C09K8/80 C04B41/00 E21B43/267

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)
 C09K C04B E21B B32B B29C

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, A	US 2007/075455 A1 (MARINI BONNIE D [US] ET AL) 5 April 2007 (2007-04-05) paragraph [0026] - paragraph [0029] claims 1,5	1-41
A	US 6 187 463 B1 (NIWA SHIGEKI [JP] ET AL) 13 February 2001 (2001-02-13)	1-33
X	column 2, line 50 - column 3, line 5 column 4, line 10 - line 22 tables 1,2	34-41
A	US 5 972 529 A (NIWA SHIGEKI [JP] ET AL) 26 October 1999 (1999-10-26)	1-33
X	column 3, line 30 - column 4, line 5 tables 1,2	34-41
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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	*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
E earlier document but published on or after the international filing date	*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
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)	*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.
O document referring to an oral disclosure, use, exhibition or other means	*&* document member of the same patent family.
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 1 October 2008	Date of mailing of the international search report 17/10/2008
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Zimpfer, Emmanuel

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2008/003295

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 2005/096207 A1 (URBANEK THOMAS W [CA]) 5 May 2005 (2005-05-05) the whole document -----	24-33
X	US 4 493 875 A (BECK WARREN R [US] ET AL) 15 January 1985 (1985-01-15) column 2, line 63 - column 3, line 4 column 3, line 23 - line 37 claim 10 -----	24-33

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/003295

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.:

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

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

1. claims: 1-26, 28-30, 33

- Independant claims 1, 15, 20, 24 and 30 relates to a spherically shaped ceramic element, and its use as proppant, whereby the particle comprises a base material and an external layer, said base exerting a compressive force on said layer.

2. claims: 27, 31, 32, 34-41

Independant claim 34 claims a method for manufacturing a ceramic element, comprising also a base material and an external layer, whereby said layer exerts a compressive force on said base.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2008/003295

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007075455	A1	05-04-2007	NONE
US 6187463	B1	13-02-2001	NONE
US 5972529	A	26-10-1999	TW 405132 B 11-09-2000
US 2005096207	A1	05-05-2005	CA 2447928 A1 04-05-2005
			CA 2540415 A1 04-05-2005
			CA 2540429 A1 04-05-2005
US 4493875	A	15-01-1985	NONE