

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 June 2010 (03.06.2010)

(10) International Publication Number
WO 2010/061162 A3

PCT

(51) International Patent Classification:

C09K 8/46 (2006.01) **C04B 28/04** (2006.01)
C09K 8/70 (2006.01) **E21B 43/04** (2006.01)
C04B 20/00 (2006.01) **C09K 8/80** (2006.01)

(21) International Application Number:

PCT/GB2009/002596

(22) International Filing Date:

2 November 2009 (02.11.2009)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

12/263,954 3 November 2008 (03.11.2008) US

(71) Applicant (for all designated States except US): **HAL-LIBURTON ENERGY SERVICES, INC.** [US/US];
P.O. Box 1431, Duncan, OK 73536 (US).

(71) Applicant (for MW only): **TURNER, Craig, Robert**
[GB/GB]; A A Thornton & Co, 235 High Holborn, London WC1V 7LE (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **RODDY, Craig, Wayne** [US/US]; 2906 Timber Ridge Drive, Duncan, OK 73533 (US).

(74) Agents: **TURNER, Craig, Robert** et al.; A A Thornton & Co, 235 High Holborn, London WC1V 7LE (GB).

(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, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- 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:

10 September 2010

(54) Title: CEMENT COMPOSITIONS AND METHODS UTILIZING NANO-HYDRAULIC CEMENT

(57) Abstract: An exemplary method includes introducing a treatment fluid comprising nano-hydraulic cement into a subterranean formation. The treatment fluid may include a drilling fluid, a completion fluid, a stimulation fluid, a well clean-up fluid or a cement composition. Another example method comprises introducing a cement composition comprising nano-hydraulic cement, hydraulic cement, and water into a subterranean formation; and allowing the cementing composition to set in the subterranean formation. An example well treatment fluid comprises nano-hydraulic cement.



WO 2010/061162 A3

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2009/002596

A. CLASSIFICATION OF SUBJECT MATTER

INV. C09K8/46 C09K8/70 C04B20/00 C04B28/04 E21B43/04
C09K8/80

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

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.
X	US 5 125 455 A (HARRIS KIRK L [US] ET AL) 30 June 1992 (1992-06-30) cited in the application claims 1-11 table II column 17 - column 20 column 7, line 32 - line 51 -----	1-23, 28-31
X	US 2007/056732 A1 (RODDY CRAIG W [US] ET AL) 15 March 2007 (2007-03-15) claims 11-35 -----	1-2, 4-5, 7, 14, 18-19, 23-24, 29-31
A	US 2002/073894 A1 (GENGE BRIAN R [US] ET AL) 20 June 2002 (2002-06-20) the whole document ----- -/--	1-23, 28-31

☒ 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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

13 January 2010

Date of mailing of the international search report

19/07/2010

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/GB2009/002596

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	DE 10 2007 042078 A1 (EPG ENGINEERED NANOPRODUCTS GE [DE]) 12 March 2009 (2009-03-12) the whole document	1-2, 4-6, 14, 16-17, 19, 23, 28-31

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2009/002596

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.:

1-23, 28-31

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: 1-23, 28-31

A method comprising introducing a treatment fluid comprising nano-hydraulic cement into a subterranean formation.

A method of cementing in a subterranean formation comprising introducing a cement composition comprising nano-hydraulic cement and water into the subterranean formation; and allowing the cementing composition to set in the subterranean formation.

2. claims: 24-25

A method of fracturing in a subterranean formation comprising fracturing the subterranean formation; and introducing a proppant comprising a nano-particle into one or more fractures in the subterranean formation.

3. claims: 26-27

A method of gravel packing in a subterranean formation comprising depositing a volume of particulate comprising a nano-particle into a well bore to at least partially reduce the migration of unconsolidated formation particulates into the well bore.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2009/002596

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5125455	A	30-06-1992	AU 643110 B2 04-11-1993
		CA 2058869 A1 09-07-1992	
		DE 69205444 D1 23-11-1995	
		DE 69205444 T2 11-04-1996	
		DK 0494748 T3 04-03-1996	
		EP 0494748 A2 15-07-1992	
		GR 3018666 T3 30-04-1996	
		NO 920088 A 09-07-1992	
US 2007056732	A1	15-03-2007	CA 2658155 A1 17-01-2008
			CN 101484400 A 15-07-2009
			EP 2038234 A1 25-03-2009
			WO 2008007040 A1 17-01-2008
US 2002073894	A1	20-06-2002	NONE
DE 102007042078	A1	12-03-2009	EP 2185483 A1 19-05-2010
			WO 2009030758 A1 12-03-2009