



(51) International Patent Classification:

B01J 13/06 (2006.01) *A61K 9/50* (2006.01)
B01J 13/16 (2006.01) *C09B 67/00* (2006.01)
B01J 13/18 (2006.01) *C11D 3/50* (2006.01)
A01N 25/28 (2006.01)

(21) International Application Number:

PCT/US2012/040158

(22) International Filing Date:

31 May 2012 (31.05.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/493,070 3 June 2011 (03.06.2011) US

(71) Applicant (for all designated States except US): **DOW GLOBAL TECHNOLOGIES LLC** [US/US]; 2040 Dow Center, Midland, MI 48674 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DRAKE, Ian** [US/US]; 114 West Highland Avenue, Philadelphia, PA 19118 (US). **HUGHES, Andrew** [US/US]; 48 Skyview Way, Newtown, PA 18940 (US). **TUCKER, Christopher, J.** [US/US]; 5406 Wanetah, Midland, MI 46840 (US).

KALANTAR, Thomas, H. [US/US]; 6203 Peachtree Circle, Midland, MI 48642 (US). **KATZ, Joshua** [US/US]; 215 Valley Road, Merion Station, PA 19066 (US).

(74) Agents: **SIMS, Norman L.** et al.; Dobrusin & Thennisch PC, 29 W. Lawrence Street, Suite 210, Pontiac, MI 48342 (US).

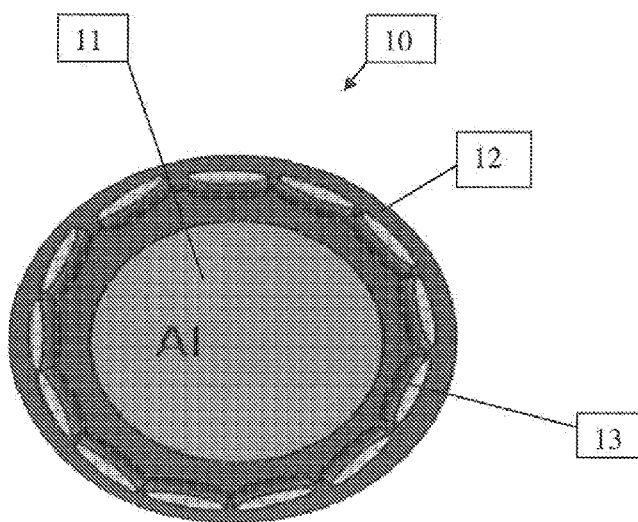
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, 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, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, 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, RS, SE, SI, SK, SM,

[Continued on next page]

(54) Title: ENCAPSULATED POLAR MATERIALS AND METHODS OF PREPARATION

Figure 1



(57) Abstract: The present invention meets one or more of the above needs and is a composition comprising plurality of capsules wherein the capsules comprise: a core of one or more highly polar liquids; one or more polar active materials dissolved in or dispersed in one or more highly polar liquids; a mixture of one or more polymers and one of more highly polar liquids; or a mixture of one or more polymers, one or more highly polar liquids and one or more polar active materials, and a shell comprising, particles in a polymer matrix or particles; wherein the thickness of the shell is sufficient to prevent passage of the highly polar liquid or the active material through the shell or to control the rate passage of the highly polar liquid or the active material through the shell with the proviso that the one or more polymers may be located in the core, in the polymer matrix of the shell or both.





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

— 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))

Published:

— with international search report (Art. 21(3))

(88) Date of publication of the international search report:

16 May 2013

INTERNATIONAL SEARCH REPORT

International application No PCT/US2012/040158

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B01J13/06 B01J13/16 B01J13/18 A01N25/28 A61K9/50
 C09B67/00 C11D3/50
 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)
 B01J A01N A61K C09B C11D

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.
X	EJKOVA J ET AL: "Investigation of internal microstructure and thermo-responsive properties of composite PNIPAM/silica microcapsules", JOURNAL OF COLLOID AND INTERFACE SCIENCE, ACADEMIC PRESS, NEW YORK, NY, US, vol. 346, no. 2, 15 June 2010 (2010-06-15), pages 352-360, XP027030370, ISSN: 0021-9797 [retrieved on 2010-03-03] page 353 page 359 - page 360 figure 1 ----- -/--	1-15, 17-20

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p>
---	---

Date of the actual completion of the international search 18 December 2012	Date of mailing of the international search report 12/03/2013
---	--

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 Tarallo, Anthony
--	--

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/040158

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GAO Q ET AL: "Suspension polymerization based on inverse Pickering emulsion droplets for thermo-sensitive hybrid microcapsules with tunable supracolloidal structures", POLYMER, ELSEVIER SCIENCE PUBLISHERS B.V, GB, vol. 50, no. 12, 5 June 2009 (2009-06-05), pages 2587-2594, XP026132517, ISSN: 0032-3861, DOI: 10.1016/J.POLYMER.2009.03.049 [retrieved on 2009-04-12] page 2588 page 2593 figure 2	1-15, 17-19
X	----- LIU H ET AL: "One-pot fabrication of magnetic nanocomposite microcapsules", MATERIALS LETTERS, NORTH HOLLAND PUBLISHING COMPANY. AMSTERDAM, NL, vol. 63, no. 11, 30 April 2009 (2009-04-30), pages 884-886, XP025989594, ISSN: 0167-577X, DOI: 10.1016/J.MATLET.2009.01.034 [retrieved on 2009-01-21] page 884 - page 886 figure 2	1-15, 17-19
A	----- US 5 804 298 A (MOY JERRY [US]) 8 September 1998 (1998-09-08) the whole document	1-15, 17-20
A	----- ZHANG K ET AL: "Magnetic polymer enhanced hybrid capsules prepared from a novel Pickering emulsion polymerization and their application in controlled drug release", COLLOIDS AND SURFACES. A, PHYSICACHEMICAL AND ENGINEERING ASPECTS, ELSEVIER, AMSTERDAM, NL, vol. 349, no. 1-3, 5 October 2009 (2009-10-05), pages 110-116, XP026624158, ISSN: 0927-7757, DOI: 10.1016/J.COLSURFA.2009.08.005 [retrieved on 2009-08-12] the whole document	1-15, 17-20
	----- -/--	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/040158

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	ZHANG K ET AL: "Pickering emulsion polymerization: Preparation of polystyrene/nano-SiO ₂ composite microspheres with core-shell structure", POWDER TECHNOLOGY, ELSEVIER SEQUOIA, LAUSANNE, CH, vol. 190, no. 3, 25 March 2009 (2009-03-25), pages 393-400, XP025952388, ISSN: 0032-5910, DOI: 10.1016/J.POWTEC.2008.08.022 [retrieved on 2008-08-27] the whole document	1-15, 17-20
A	----- WENBAO CHEN ET AL: "Synthesis of microcapsules with polystyrene/ZnO hybrid shell by Pickering emulsion polymerization", COLLOID AND POLYMER SCIENCE ; KOLLOID-ZEITSCHRIFT UND ZEITSCHRIFT FÜR POLYMERE, SPRINGER, BERLIN, DE, vol. 288, no. 14-15, 13 August 2010 (2010-08-13), pages 1393-1399, XP019846857, ISSN: 1435-1536 the whole document -----	1-15, 17-20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/040158

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.:
1-15, 17, 20(completely); 18, 19(partially)

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: 1-15, 17, 20(completely); 18, 19(partially)

- * A composition comprising a plurality of capsules
- * A process for making capsules
- * A capsule

2. claims: 16(completely); 18, 19(partially)

- * A process wherein a polymer is formed from monomers comprising cyanoacrylates

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/040158

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5804298	A	08-09-1998	CA	2080424 A1	26-04-1993
			DE	69227974 D1	04-02-1999
			DE	69227974 T2	22-07-1999
			EP	0539142 A1	28-04-1993
			JP	3399990 B2	28-04-2003
			JP	5212272 A	24-08-1993
			US	5804298 A	08-09-1998
