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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 October 2009 (01.10.2009)

PCT

(10) International Publication Number
WO 2009/120846 A3

(51) International Patent Classification:
C09C 3/00 (2006.01) *B82B 3/00* (2006.01)

(21) International Application Number:
PCT/US2009/038367

(22) International Filing Date:
26 March 2009 (26.03.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/040,338 28 March 2008 (28.03.2008) US

(71) Applicant *(for all designated States except US)*: **3M INNOVATIVE PROPERTIES COMPANY** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **TIEFENBRUCK, Grant, F.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **ARCHIBALD, Matthew, N.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **NELSON, James, M.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **THOMPSON, Wendy, L.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **SCHULTZ, William, J.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **CONDO, Peter, D.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **KOLB, Brant, U.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). **BARAN, Jimmie, R. Jr.** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).

(74) Agents: **PASTIRIK, Daniel, R.** et al.; 3M Center Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, MN 55133-3427 (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, 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, 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, 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:
7 January 2010

(54) Title: PROCESS FOR THE SURFACE MODIFICATION OF PARTICLES

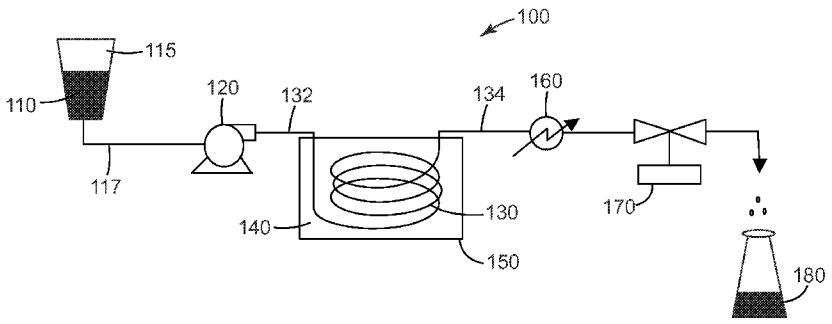


Fig. 1

(57) Abstract: A method for the preparation of functionalized particles includes providing a feedstock that includes particles, a surface treatment agent reactive with the particles and solvent. The feedstock is direct through a continuous hydrothermal reactor maintained at a temperature sufficient to react the particles with the surface treatment agents to thereby provide functionalized particles. The method of the invention is capable of providing the functionalized particles in less than about 4 hours.

WO 2009/120846 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/038367

A. CLASSIFICATION OF SUBJECT MATTER

C09C 3/00(2006.01)i, B82B 3/00(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)

IPC: C01B, C01C, C01G, C08K, B82B

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 since 1975

Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal), Sciencedirect, MRS proceedings, ACS journals

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0003463 A1 (AJIRI, T.) 04 January 2007 See abstract; paragraphs [0021] - [0056], [0076] - [0127]; figures 03, 05, 06, 14(b), 16(b), 17; and all examples.	1-40
Y	Schmidt, H. K. et al., Fabrication of agglomerate-free nanopowders by hydrothermal chemical processing, in Nanostructured Powders and Their Industrial Application, edited by G. Beaucage et al. (Mater. Res. Soc. Symp. Proc. Volume 520, Warrendale, PA, 1998), pp.21-31. See abstract.	1-40
A	KR 10-2007-0098781 A (LEIBNIZ-INSTITUT FUR NEUE MATERIALIEN GEMEINNUTZIGE GMBH) 05 October 2007 See the whole document.	1-40
A	US 2006/0148950 A1 (DAVIDSON, R. S. et al.) 06 July 2006 See the whole document.	1-40
A	US 2005/0063898 A1 (Ja CHISHOLM, B.) 24 March 2005 See the whole document.	1-40

☒ 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 NOVEMBER 2009 (10.11.2009)	**10 NOVEMBER 2009 (10.11.2009)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHO Han Sol

Telephone No. 82-42-481-5580

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/038367

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 2007/0098990 A1 (COOK, R. L. et al.) 03 May 2007 See the whole document.	1-40
A	US 2007/0032560 A1 (SUEMURA, N. et al.) 08 February 2007 See the whole document.	1-40
A	US 2002/0055580 A1 (LORAH, D. P. et al.) 09 May 2002 See the whole document.	1-40

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/038367

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007-0003463 A1	04.01.2007	None	
KR 10-2007-0098781 A	05.10.2007	CN 101124166 A	13.02.2008
		CN 101124166 A0	13.02.2008
		EP 1797006 A2	20.06.2007
		JP 2008-515747 A	15.05.2008
		US 2009-0004098 A1	01.01.2009
		WO 2006-037591 A2	13.04.2006
		WO 2006-037591 A3	13.04.2006
US 2006-0148950 A1	06.07.2006	CN 101132989 A0	27.02.2008
		CN 101132989 A	27.02.2008
		EP 1836128 A1	26.09.2007
		JP 2008-526669 A	24.07.2008
		US 2007-0232705 A1	04.10.2007
		US 2008-305943 A1	11.12.2008
		US 7241437 B2	10.07.2007
		US 7429422 B2	30.09.2008
		WO 2006-073783 A1	13.07.2006
US 2005-0063898 A1	24.03.2005	AT 402227 T	15.08.2008
		CN 1597616 C0	23.03.2005
		CN 100384779 C	30.04.2008
		CN 1597616 A	23.03.2005
		DE 602004015210 D1	04.09.2008
		EP 1510557 A3	11.01.2006
		EP 1510557 A2	02.03.2005
		EP 1510557 B1	23.07.2008
		JP 2005-075723 A	24.03.2005
		KR 10-2005-0021881 A	07.03.2005
		US 7169375 B2	30.01.2007
		US 2008-0275170 A1	06.11.2008
US 2007-0098990 A1	03.05.2007	US 6887517 B1	03.05.2005
		US 6933046 B1	23.08.2005
		US 6986943 B1	17.01.2006
		US 7244498 B2	17.07.2007
		US 2005-0176851 A1	11.08.2005
US 2007-0032560 A1	08.02.2007	EP 1754685 A2	21.02.2007
		EP 1754685 A3	18.04.2007
		JP 2007-063117 A	15.03.2007
		KR 10-2007-0016082 A	07.02.2007
US 2002-055580 A1	09.05.2002	US 6765049 B2	20.07.2004