

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
19 November 2009 (19.11.2009)

PCT

(10) International Publication Number
WO 2009/140030 A3

- (51) International Patent Classification:

B22F 9/24 (2006.01)	C01F 7/02 (2006.01)
B22F 1/00 (2006.01)	C01B 33/157 (2006.01)
- (21) International Application Number:
PCT/US2009/041286
- (22) International Filing Date:
21 April 2009 (21.04.2009)
- (25) Filing Language:
English
- (26) Publication Language:
English
- (30) Priority Data:
61/053,588 15 May 2008 (15.05.2008) US
- (71) Applicant (for all designated States except US): **ARIZONA BOARD OF REGENTS for and on behalf of ARIZONA STATE UNIVERSITY** [US/US]; 1475 North Scottsdale Road, Sky Song, Suite 200, Scottsdale, AZ 85257-9908 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **SEO, Dong-Kyun** [KR/US]; 3415 E. Beechnut Place, Chandler, AZ 85249 (US). **LADD, Danielle** [US/US]; 10290 Nelson Street, Westminster, CO 80021 (US). **VOLOSIN, Alex** [US/US]; 1321 So. Hardy Drive, Tempe, AZ 85281-6336 (US).
- (74) Agent: **FLANAGAN, Heather, L.**; Fish & Richardson P.C., P.O. Box 1022, Minneapolis, MN 55440-1022 (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.

[Continued on next page]

(54) Title: POROUS METAL OXIDE PARTICLES

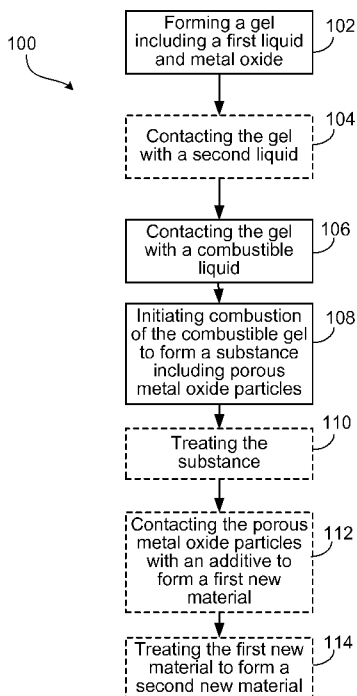


FIG. 1

(57) Abstract: Preparing porous particles includes forming a gel including a first liquid and an oxygen-containing compound of a metal, semi-metal, metalloid, or semi-conductor, including an oxide, hydroxide, alkoxide, oxohydroxide, oxoalkoxide, oxo salt, or oxo salt hydrate of the metal, semi-metal, metalloid, or semi-conductor; contacting the gel with a combustible liquid to form a combustible gel; and initiating combustion of the combustible gel to form a substance including porous metal, semi-metal, metalloid, or semi-conductor oxide particles. The combustible liquid can include a volatile solvent. The porous particles have open pores with a range of nanoscale pore sizes. The porous particles may be treated further to form, for example, a composite.

WO 2009/140030 A3



(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).

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

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))*

Declarations under Rule 4.17:

(88) Date of publication of the international search report:
18 February 2010

A. CLASSIFICATION OF SUBJECT MATTER**B22F 9/24(2006.01)i, B22F 1/00(2006.01)i, C01F 7/02(2006.01)i, C01B 33/157(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 B22F 9/24; C04B 35/624

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)

e-Kompass "gel, combustion, combustible gel, porous particles"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008-0090716 A1 (CHERPYPY, NERINE J. et al.) 17 April 2008 See abstract; figure 1; and claim 1	1-25
A	NEDELEC, J. M. Sol-Gel Processing of Nanostructured Inorganic Scintillating Materials, Journal of Nanomaterials Volume 2007, Article ID 36392, 8 pages See 4.3. Aluminates	1-25
A	SIVASHANMUGAM, A. et al. Glycine-Assisted Sol-Gel Combustion Synthesis and Characterization of Aluminum-Doped LiNiVO ₄ for Use in Lithium-Ion Batteries, Journal of The Electrochemical Society, Volume 153 No. 3 A497-A503 (2006) See experimental; and figure 1	1-25
A	JU DONG-YING et al. Low-temperature sintering method for NiCuZn ferrite and effect of Mn addition on electromagnetic properties, Transactions of Nonferrous Metals Society of China, Volume 16, Supplement 1, June 2006, Pages s67-s70 See experimental	1-25

 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

08 DECEMBER 2009 (08.12.2009)

Date of mailing of the international search report

16 DECEMBER 2009 (16.12.2009)

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

LEE, SUNG JOON

Telephone No. 82-42-481-5530



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/041286

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US20080090716 A1	17.04.2008	None	