

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
18 March 2010 (18.03.2010)

(10) International Publication Number  
**WO 2010/030120 A3**

- (51) International Patent Classification:  
A61K 51/00 (2006.01)
- (21) International Application Number:  
PCT/KR2009/005121
- (22) International Filing Date:  
9 September 2009 (09.09.2009)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
10-2008-0089014  
9 September 2008 (09.09.2008) KR
- (71) Applicants (for all designated States except US): SNU R&DB FOUNDATION [KR/KR]; San56-1, Shinlim-dong, Gwanak-gu, Seoul 151-742 (KR). THE INTELLECTUAL PROPERTY AND TECHNOLOGY LICENSING PROGRAM [SA/SA]; P.O.Box 2454, Riyadh, 11451 (SA).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): CHUNG, DooSoo [KR/KR]; 122H-dong, 305 ho, Professor APT of SNU, Nakseongdae-dong, Gwanak-gu, Seoul 151-057 (KR). KANG, Keonwook [KR/KR]; 801 ho, KCC EmpireRiver, Hapjeong-dong, Mapo-gu, Seoul 121-793 (KR). JEON, Yonghyun [KR/KR]; 603dong 1104 ho, Buyoung 6th APT, Hwasun-eup, Hwasun-gun, Cheonnam 519-800 (KR). KIM, Younghwa [KR/KR]; 21 dong 1003 ho,

Seongsan siyoung APT, Seongsan 2-dong, Mapo-gu, Seoul 121-252 (KR). ALOTHMAN, Zeid, A. [SA/SA]; Chemistry Department P.O. Box 2455, College of Science Building 5, King Saud University, Riyadh, 11451 (SA). AHMED, Ahmed Yacine Hadj [SA/SA]; Chemistry Department P.O. Box 2455, College of Science Building 5, King Saud University, Riyadh, 11451 (SA). CHOI, Kihwan [KR/KR]; Hanareum mael 501 ho, Shinlimbon-dong, Gwanak-gu, Seoul 151-029 (KR). AIMAJD, Abdullah, M. [SA/SA]; Chemistry Department P.O. Box 2455, College of Science Building 5, King Saud University, Riyadh, 11451 (SA). PIAO, Jingyu [CN/KR]; National University, Shinlim 9-dong, Gwanak-gu, Seoul 151-818 (CN). ALOTHMAN, Asma, A. [SA/SA]; Chemistry Department P.O. Box 2455, College of Science Building 5, King Saud University, Riyadh, 11451 (SA). QUAN, Bo [KR/KR]; Seoul National University, San 56-1, Shinlim-dong, Gwanak-gu, Seoul 151-050 (KR).

(74) Agent: PARK, Jin, Ho; Romm#504, SK Hub Blue,708-26, Yeoksam2-dong, Gangnam-gu, Seoul 135-919 (KR).

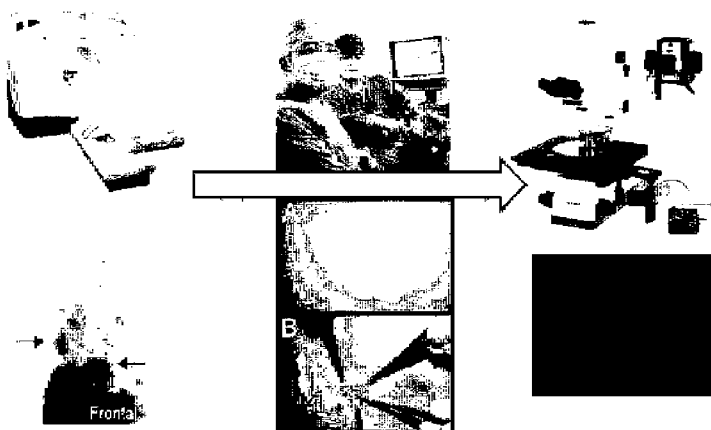
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO,

[Continued on next page]

(54) Title: FLUORESCENT SILICA NANOPARTICLE WITH RADIOACTIVE TAG AND THE DETECTING METHOD OF PET AND FLUORESCENT DUAL IMAGING USING THEREOF

[Fig. 1]

### RI + Fluorescent Image



(57) Abstract: The present invention relates to nuclear medicine using fluorescent silica nanoparticle and detecting method of optical dual imaging, and more particularly to radioisotope labeled fluorescent silica nanoparticles which are used for PET (positron emission tomography) and fluorescence detecting, and detecting method of PET and fluorescent dual imaging using thereof. Functionalized silica nanoparticles of this invention have promising potential as a role for organic lymphatic tracer in biomedical imaging such as pre- and intra-operative surgical guidance.



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:**

22 July 2010

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/KR2009/005121****A. CLASSIFICATION OF SUBJECT MATTER****A61K 51/00(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)

A61K 51/00; A61K 49/00; C07K 16/46; none

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  
Japanese utility models and applications for utility models  
(Chinese Patents and application for patent)

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

eKOMPASS(KIPO internal) &amp; Google Scholar

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 2007-034196 A2 (AION DIAGNOSTICS LTD et al.) 29 March 2007 See claims 10, 11, 14, 17, 18, 20, 25, and 59.	1-3,10 4,11-12
A	US 2006-0073100 A1 (ALAN FISCHMAN et al.) 06 April 2006 See the whole document.	1-4,10-12
T	JEON, Y.H, et al, In Vivo Imaging of Sentinel Nodes Using Fluorescent Silica Nanoparticles in Living Mice, Molecular Imaging and Biology, 2010, Vol.12, pp.155-162, Published Online 15 October 2009. See the whole document.	1-4,10-12

 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

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

26 MAY 2010 (26.05.2010)

Date of mailing of the international search report

**26 MAY 2010 (26.05.2010)**

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

KIM, EUN HEE

Telephone No. 82-42-481-5590



**INTERNATIONAL SEARCH REPORT**

International application No.

**PCT/KR2009/005121****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.: 5-9  
because they relate to subject matter not required to be searched by this Authority, namely:  
Claims 5-9 pertain to methods for treatment of the human body by diagnostic methods and thus relate to a subject matter which this International Searching Authority is not required, under Article 17(2)(a)(i) of the PCT and Rule 39.1(iv) of the Regulations under the PCT, to search.
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:

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 fee, this Authority did not invite payment of any additional fee.
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.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/KR2009/005121**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007-034196 A2	29.03.2007	None	
US 2006-0073100 A1	06.04.2006	AT 359806 T	15.05.2007
		AU 2002-327180 A8	21.01.2003
		AU 2002-360488 A1	29.09.2003
		AU 2002-360488 A8	29.09.2003
		CA 2449828-A1	16.01.2003
		CA 2478248-A1	25.09.2003
		DE 60219627 D1	31.05.2007
		DE 60219627 T2	07.02.2008
		EP 1401479 A2	31.03.2004
		EP 1401479 A4	16.03.2005
		EP 1401479 B1	18.04.2007
		EP 1575414 A2	21.09.2005
		EP 1575414 A4	20.02.2008
		JP 2005-502618 A	27.01.2005
		JP 2005-502618 T	27.01.2005
		JP 2005-538751 A	22.12.2005
		JP 2005-538751 T	22.12.2005
		US 2003-0055307 A1	20.03.2003
		US 2003-0082105 A1	01.05.2003
		US 2003-0103995 A1	05.06.2003
		US 2007-0258906 A1	08.11.2007
		WO 03-003975 A2	16.01.2003
		WO 03-003975 A3	16.01.2003
		WO 03-077723 A2	25.09.2003
		WO 03-077723 A3	25.09.2003
		WO 0300-3975A3	11.12.2003
		WO 0307-7723A3	12.07.2007