



(43) International Publication Date
12 April 2012 (12.04.2012)

- (51) International Patent Classification:
G02B 6/12 (2006.01) *G02F 1/025* (2006.01)
- (21) International Application Number:
PCT/US2011/055364
- (22) International Filing Date:
7 October 2011 (07.10.2011)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/391,193 8 October 2010 (08.10.2010) US
- (71) Applicant (for all designated States except US): **CORNELL UNIVERSITY** [US/US]; 395 Pine Tree Road, Suite 310, Ithaca, New York 14850 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **ERICKSON, David** [CA/US]; 205 East Marshall Street, Ithaca, New York 14850 (US). **CHEN, Yih-Fan** [CN/CN]; 9F., No. 17, Ln. 188, Jungong Road, Taipei City 116 (TW).
- (74) Agent: **GREENER, William**; 10 Brown Road, Suite 102, Bond, Schoeneck & King, PLLC, Ithaca, New York 14850 (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, MD, 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, 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))

- (88) Date of publication of the international search report:
5 July 2012

(54) Title: OPTICAL TRAPPING APPARATUS, METHODS AND APPLICATIONS USING PHOTONIC CRYSTAL RESONATORS

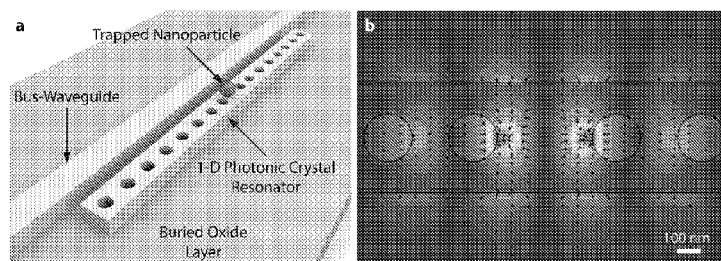


FIG. 1

(57) Abstract: A plurality of photonic crystal resonator optical trapping apparatuses and a plurality optical trapping methods using the plurality of photonic crystal resonator optical trapping apparatuses include located and formed over a substrate a photonic waveguide that is coupled (i.e., either separately coupled or integrally coupled) with a photonic crystal resonator. In a particular embodiment, the photonic waveguide and the photonic crystal resonator comprise a monocrystalline silicon (or other) photonic material absent any chemical functionalization. In another particular embodiment, the photonic waveguide and the photonic crystal resonator comprise a silicon nitride material which when actuating the photonic crystal resonator optical trapping apparatus with a 1064 nanometer resonant photonic radiation wavelength (or other resonant photonic radiation wavelength in a range from about 700 to about 1200 nanometers) provides no appreciable heating of an aqueous sample fluid that is analyzed by the photonic crystal resonator optical trapping apparatus.



A. CLASSIFICATION OF SUBJECT MATTER**G02B 6/12(2006.01)i, G02F 1/025(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)

G02B 6/12; G02B 26/00; H01L 27/14; G02B 6/10

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

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

eKOMPASS(KIPO internal) & Keywords: WAVEGUIDE, RESONATOR, TRAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MANDAL et al. `Nanomaniplulation Using Silicon Photonic Crystal Resonators`, Nano Lett., 2010, 10(1), pp.99-104, 02 December 2009 See abstract, page 99-103, and figures 1-3.	1-23
A	US 2010-0046901 A1 (STOEFERLE THILO H. C.) 25 February 2010 See abstract; claim 1 and figure 3	1-23
A	JP 2008-233769 A (TOHOKU UNIV.) 02 October 2008 See abstract; claim 1 and figure 1	1-23
A	US 2007-0096231 A1 (PHILIP KUEKES et al.) 03 May 2007 See abstract; claim 1 and figure 1	1-23

 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

28 MARCH 2012 (28.03.2012)

Date of mailing of the international search report

10 APRIL 2012 (10.04.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsa-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

Jung, Jong Han

Telephone No. 82-42-481-5642



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/055364

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0046901 A1	25.02.2010	None	
JP 2008-233769 A	02.10.2008	None	
US 2007-0096231 A1	03.05.2007	US 7545999 B2 WO 2007-053762 A1	09.06.2009 10.05.2007