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- 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:
13 February 2014

(54) Title: MULTI-BANDGAP SEMICONDUCTOR STRUCTURES AND METHODS FOR USING THEM

(57) Abstract: Described herein are multi-segmented nanowires, nanosheets and nanobelts, and devices and methods using them for the generation of multicolor and white light.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/031313**A. CLASSIFICATION OF SUBJECT MATTER****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)

B82B 3/00; H01S 3/10; H01L 29/221; H01L 21/20; H01L 33/18; H01L 29/12; H01L 33/00; H01B 1/10; G02F 1/35

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: radiation, energy, pumping, semiconductor, nanowire, nanobelt, nanosheet, bandgap, emission, dimension, length, width

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2011-123257 A1 (EASTMAN KODAK COMPANY) 06 October 2011 See claims 15, 16.	1-5,36-41,71
A	US 2006-0050749 A1 (SETZLER, S. D.) 09 March 2006 See claims 1, 4.	1-5,36-41,71
A	US 2011-0316043 A1 (KOUVETAKIS, J. et al.) 29 December 2011 See claim 1.	1-5,36-41,71
A	US 2011-0254052 A1 (KOUVETAKIS, J. et al.) 20 October 2011 See abstract and claim 1.	1-5,36-41,71
A	US 2011-0272744 A1 (NING, C. Z. et al.) 10 November 2011 See abstract and claim 1.	1-5,36-41,71



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 another 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

24 December 2013 (24.12.2013)

Date of mailing of the international search report

26 December 2013 (26.12.2013)

Name and mailing address of the ISA/KR


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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/031313

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.: 10-11, 13, 30-31, 34-35, 46-47, 49, 69-70
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:
Claims 10-11, 13, 30-31, 34-35, 46-47, 49, 69-70 are unclear because they refer to multiple dependent claims 9, 28, 33, 32, 45, 48, 68 which do not comply with PCT Rule 6.4(a). Thus, no meaningful opinion could be established.

3. ☒ Claims Nos.: 6-9, 12, 14-29, 32-33, 42-45, 48, 50-68
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 fees, this Authority did not invite payment of any 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.:

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/US2013/031313

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011-123257 A1	06/10/2011	US 2011-0240099 A1 US 2011-0240953 A1 US 7906354 B1 US 8273640 B2	06/10/2011 06/10/2011 15/03/2011 25/09/2012
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US 2011-0272744 A1	10/11/2011	WO 2010-054231 A1	14/05/2010