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(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, BN, 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, PA, 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.

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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

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30 January 2014

(54) Title: HIGH-THROUGHPUT CONTINUOUS GAS-PHASE SYNTHESIS OF NANOWIRES WITH TUNABLE PROPERTIES

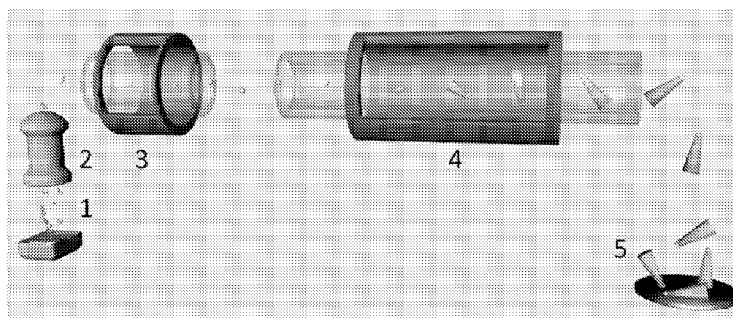


Fig. 1

(57) Abstract: A method for forming wires, including providing catalytic seed particles suspended in a gas, providing gaseous precursors that comprise constituents of the wires to be formed and growing the wires from the catalytic seed particles. The wires may be grown in a temperature range between 425 and 525 C and may have a pure zincblende structure. The wires may be III-V semiconductor nanowires having a Group V terminated surface and a <111>B crystal growth direction.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2013/000626

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet		
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: B82Y, C30B, H01L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data, COMPENDEX, EMBASE, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011142717 A1 (QUNANO AB ET AL), 17 November 2011 (2011-11-17); page 1, line 4 - line 6; page 14, line 1 - line 17; page 15, line 18 - line 34 --	1-4
A	WO 2011078780 A1 (QUNANO AB ET AL), 30 June 2011 (2011-06-30); page 5, line 17; page 1, line 8 - page 2, line 8 --	1
A	'Understanding ion-mobility and transport properties of aerosol nanowires', Kim et al., Journal of Aerosol Science, vol 28 (2007), NR 8, page 823 - 842.; pages 825-826 --	1
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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		Date of mailing of the international search report
06-11-2013		06-11-2013
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86		Authorized officer Fredrik Wahlin Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2013/000626

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	'Growth of GaP nanotree structures by sequential seeding of 1D nanowires', Dick et al., Journal of Crystal Growth, Vol 272 (2004), NR 1-4, page 131-137; pages 132-133 --	1
A	US 20090053126 A1 (LEE EUN KYUNG ET AL), 26 February 2009 (2009-02-26); paragraphs [0073]-[0085] -- -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2013/000626

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.:
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:

See extra sheet.

- 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 additional fees, this Authority did not invite payment of 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.: **1-4 and 11 (Invention 1a)**

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.

Continuation of: Box No. III

The following separate inventions were identified a priori as:

- 1: Claims 1-13 directed to the growing temperature of wires.
- 2: Claims 1-13 directed to wires with zincblende structure.
- 3: Claims 14-23 directed to III-V semiconductor nanowires having a Group V terminated surface and a <111>B crystal growth direction.

The following separate inventions were identified a posteriori:

- 1a: Claims 1-4, 11 directed to growing of wires in a temperature range between 425 °C and 525 °C and that the wires comprises one or more of Ga, Al, In and one or more of As, P, N or Sb.
- 1b: Claims 5-6 directed to the growth rate of the wires.
- 1c: Claim 7-10 directed to the dimension of the wire and material choice of the seed particle.
- 1d: Claim 12-13 directed to the crystal structure of the nanowire.

Continuation of: second sheet

International Patent Classification (IPC)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2013/000626

WO	2011142717 A1	17/11/2011	CN	102971452 A	13/03/2013
			EP	2569466 A1	20/03/2013
			JP	2013526474 A	24/06/2013
			US	20130098288 A1	25/04/2013
WO	2011078780 A1	30/06/2011	CN	102770367 A	07/11/2012
			EP	2516323 A1	31/10/2012
			JP	2013515370 A	02/05/2013
			KR	20120130751 A	03/12/2012
			US	20130203242 A1	08/08/2013
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