

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
7 September 2007 (07.09.2007)

PCT

(10) International Publication Number
WO 2007/101138 A3

(51) International Patent Classification:

H01L 31/00 (2006.01) **B05D 7/00** (2006.01)
B05D 1/12 (2006.01) **B05D 7/24** (2006.01)
B05D 3/00 (2006.01)

(21) International Application Number:

PCT/US2007/062766

(22) International Filing Date:

23 February 2007 (23.02.2007)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

11/361,433	23 February 2006 (23.02.2006)	US
11/361,497	23 February 2006 (23.02.2006)	US
11/361,515	23 February 2006 (23.02.2006)	US
11/361,103	23 February 2006 (23.02.2006)	US
11/361,521	23 February 2006 (23.02.2006)	US
11/361,522	23 February 2006 (23.02.2006)	US
11/394,849	30 March 2006 (30.03.2006)	US
11/395,438	30 March 2006 (30.03.2006)	US
11/395,668	30 March 2006 (30.03.2006)	US

(71) Applicants and

(72) Inventors: **VAN DUREN, Jeroen, K., J.** [NL/US];
903 Fremont Street, Menlo Park, CA 94025 (US). **LEI-
DHOLM, Craig, R.** [US/US]; 934 La Mesa Terrace,
Sunnyvale, CA 94086 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **ROBINSON,
Matthew, R.** [US/US]; 2440 Embarcadero Way, Palo Alto,
CA 94303 (US).

(74) Agent: **TUNG, Hao, Y.**; 5521 Hellyer Avenue, San Jose,
CA 95138 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, 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, LV, LY, MA, MD, 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, 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, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

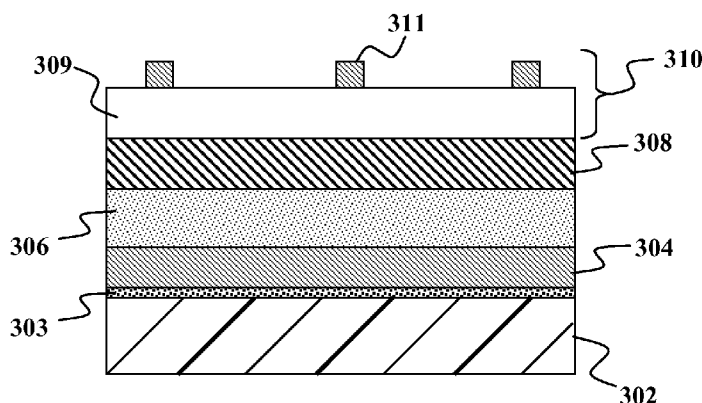
Published:

— with international search report

[Continued on next page]

(54) Title: HIGH-THROUGHPUT PRINTING OF SEMICONDUCTOR PRECURSOR LAYER FROM INTER-METALLIC
NANOFLAKE PARTICLES

300



(57) Abstract: Methods and devices are provided for transforming non-planar or planar precursor materials in an appropriate vehicle under the appropriate conditions to create dispersions of planar particles with stoichiometric ratios of elements equal to that of the feedstock or precursor materials, even after selective forces settling. In particular, planar particles disperse more easily, form much denser coatings (or form coatings with more interparticle contact area), and anneal into fused, dense films at a lower temperature and/or time than their counterparts made from spherical nanoparticles. These planar particles may be nanoflakes that have a high aspect ratio. The resulting dense films formed from nanoflakes are particularly useful in forming photovoltaic devices. In one embodiment, at least one set of the particles in the ink may be inter-metallic flake particles (microflake or nanoflake) containing at least one group IB-IIIa inter-metallic alloy phase.

WO 2007/101138 A3



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
23 October 2008

(15) Information about Correction:
Previous Correction:
see Notice of 6 December 2007

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/62766

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **H01L 31/00**(2006.01);**B05D 1/12**(2006.01),**3/00**(2006.01),**7/00**(2006.01),**7/24**(2006.01)

USPC: 136/243,252;427/180,201,212,372.2

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)

U.S. : 136/243,252;427/180,201,212,372.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/0219730 A1 (Basol) 4 November 2004. Entire Document.	1, 2, 46-50, 54-57
---		-----
Y		58
A	US 6,127,202 (Kapur et al.) 3 October 2000. Entire Document	All
Y	US 2003/0041893 A1 (Shimakawa et al.) 6 March 2003, [0039]	101
A	JP 2001-044464 Watanabe (Asahi Chem Ind) 16 February 2001. [0013]	All
A	US 5,728,231 (Negami et al.) 17 March 1998, column 6, lines 15-22	All



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	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"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
"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	"&" document member of the same patent family

Date of the actual completion of the international search

14 August 2008 (14.08.2008)

Date of mailing of the international search report

27 AUG 2008

Name and mailing address of the ISA/US

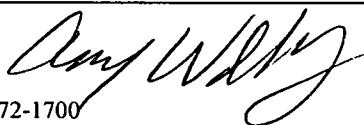
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Authorized officer

Mikhail Kornakov

Telephone No. 571-272-1700



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/62766

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.: 3-45,51-53,59-100,102-135
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 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.