(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 November 2017 (16.11.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/197204 A3

(51) International Patent Classification:
H01L 31/18 (2006.01) *H01L 31/0368* (2006.01)
H01L 31/05 (2006.01) *H01L 31/02* (2006.01)

(21) International Application Number:
PCT/US2017/032296

(22) International Filing Date:
11 May 2017 (11.05.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15/154,821 13 May 2016 (13.05.2016) US

(71) Applicant: **SUNPOWER CORPORATION** [US/US]; 77 Rio Robles, San Jose, California 95134 (US).

(72) Inventors: **SEWELL, Richard Hamilton**; 545 Covington Road, Los Altos, California 94024 (US). **BUNEA, Gabriela Elena**; 1108 Sterling Gate Drive, San Jose, California 95120 (US).

(74) Agent: **VINCENT, Lester J.** et al.; Blakely Sokoloff Taylor & Zafman LLP, 1279 Oakmead Parkway, Sunnyvale, California 94085 (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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SA, 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, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
26 July 2018 (26.07.2018)

(54) Title: ROLL-TO-ROLL METALLIZATION OF SOLAR CELLS

(57) Abstract: Disclosed herein are approaches to fabricating solar cells, solar cell strings and solar modules using roll-to-roll foil-based metallization approaches. Methods disclosed herein can comprise the steps of providing at least one solar cell wafer on a first roll unit and conveying a metal foil to the first roll unit. The metal foil can be coupled to the solar cell wafer on the first roll unit to produce a unified pairing of the metal foil and the solar cell wafer. We disclose solar energy collection devices and manufacturing methods thereof enabling reduction of manufacturing costs due to simplification of the manufacturing process by a high throughput foil metallization process.

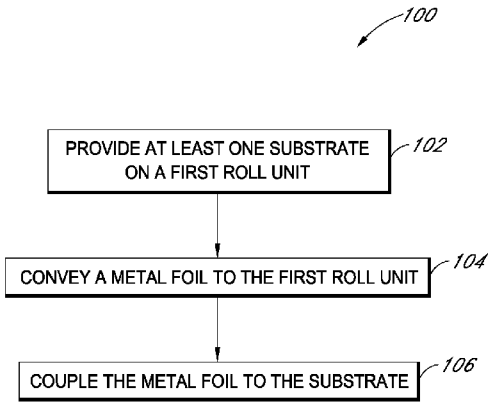


FIG. 1

WO 2017/197204 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/032296

A. CLASSIFICATION OF SUBJECT MATTER

H01L 31/18(2006.01)i, H01L 31/05(2006.01)i, H01L 31/0368(2006.01)i, H01L 31/02(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)
H01L 31/18; H01R 13/02; H01L 31/02; H01R 43/00; H01L 31/0216; H01L 31/05; B32B 37/02; B32B 37/10; H01L 31/042; H01L 31/0368

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: photovoltaic, solar cell, fabrication, roller, metal film, bonding

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012-0208411 A1 (HANS-JOACHIM KROKOSZINSKI et al.) 16 August 2012 See paragraphs [0027], [0059], [0080], [0083], [0085]; claims 17, 22, 27; and figures 4, 10.	4-12,14-15,17-20
A		1-3,13,16
Y	US 2014-0174519 A1 (SEUNG BUM RIM et al.) 26 June 2014 See paragraphs [0022], [0027], [0031]; claim 1; and figures 6-7.	4-12,14-15,17-20
Y	US 2014-0373892 A1 (MUEHLBAUER AG) 25 December 2014 See paragraphs [0084], [0102]; claim 31; and figure 1.	5-7,14
A	US 2010-0218897 A1 (SERGEY FROLOV et al.) 02 September 2010 See paragraphs [0065]-[0070]; and figures 7-9.	1-20
A	US 2014-0352777 A1 (NUVOSUN, INC.) 04 December 2014 See paragraphs [0051]-[0054]; and figure 4.	1-20

☐ 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	Date of mailing of the international search report
20 July 2017 (20.07.2017)	**24 July 2017 (24.07.2017)**

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea
Facsimile No. +82-42-481-8578

Authorized officer
Lee, Eun Kyu
Telephone No. +82-42-481-3580

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2017/032296

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012-0208411 A1	16/08/2012	CN 102473794 A	23/05/2012
		CN 102473794 B	10/12/2014
		DE 102010004112 A1	30/12/2010
		EP 2449601 A2	09/05/2012
		JP 2012-531758 A	10/12/2012
		JP 5409908 B2	05/02/2014
		KR 10-2012-0124052 A	12/11/2012
		US 9307650 B2	05/04/2016
		WO 2011-000629 A2	06/01/2011
		WO 2011-000629 A3	24/02/2011
US 2014-0174519 A1	26/06/2014	CN 104981910 A	14/10/2015
		DE 112013006103 T5	17/09/2015
		JP 2016-502283 A	21/01/2016
		KR 10-2015-0097648 A	26/08/2015
		TW 201427059 A	01/07/2014
		WO 2014-098988 A1	26/06/2014
US 2014-0373892 A1	25/12/2014	CN 104241442 A	24/12/2014
		US 9601651 B2	21/03/2017
US 2010-0218897 A1	02/09/2010	US 2009-0215215 A1	27/08/2009
		US 8343794 B2	01/01/2013
		WO 2009-105743 A2	27/08/2009
		WO 2009-105743 A3	03/12/2009
US 2014-0352777 A1	04/12/2014	CN 104094413 A	08/10/2014
		CN 104094413 B	09/11/2016
		EP 2789020 A1	15/10/2014
		EP 2789020 A4	05/08/2015
		JP 2015-503242 A	29/01/2015
		KR 10-2014-0105520 A	01/09/2014
		MX 2014006843 A	20/02/2015
		MX 339530 B	30/05/2016
		US 9530926 B2	27/12/2016
		WO 2013-086233 A1	13/06/2013