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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, IR, IS, JP, KE, KG, 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, 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, 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).

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WO 2014/123840 A3

(54) **Title:** CONDUCTIVE SILVER PASTE FOR A METAL-WRAP-THROUGH SILICON SOLAR CELL

(57) **Abstract:** A conductive silver via paste comprising particulate conductive silver, a vanadium-phosphorus-antimony-zinc-based-oxide, a tellurium-boron-phosphorus-based-oxide or a tellurium-molybdenum-cerium-based-oxide and an organic vehicle is particularly useful in providing the metallization of the holes in the silicon wafers of MWT solar cells. The result is a metallic electrically conductive via between the collector lines on the front side and the emitter electrode on the back-side of the solar cell. The paste can also be used to form the collector lines on the front-side of the solar cell and the emitter electrode on the back-side of the solar cell. Also disclosed are metal-wrap-through silicon solar cells comprising the fired conductive silver paste.

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2014/014553

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H01B1/02 H01B1/22 H01L31/00  
ADD.  
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)  
H01B H01L  
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)  
EPO-Internal, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2012 012228 A (ASAHI GLASS CO LTD) 19 January 2012 (2012-01-19) page 2; claims 1-5 page 8; examples 3,4; table 1 page 7, paragraph 42	1-5
A	----- WO 2012/125866 A1 (DU PONT [US]; HANG KENNETH WARREN [US]; WANG YUELI [US]) 20 September 2012 (2012-09-20) page 7; table 1 page 13 - page 15; claims 1-14	1-5
A	----- US 2009/266409 A1 (WANG YUELI [US] ET AL) 29 October 2009 (2009-10-29) page 5; table 1 -----	1-5

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  22 July 2014	Date of mailing of the international search report  13/11/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Jung, Andreas

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2014/014553

## 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 additional 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 an 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.:

1-5

### 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.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. claims: 1-5

A conductive silver paste comprising:(a) silver;(b) a vanadium-phosphorus-antimony-zinc-based-oxide comprising 45-60 wt% V<sub>2</sub>O<sub>5</sub> , 15-30 wt% P<sub>2</sub>O<sub>5</sub> , 5-20 wt% Sb<sub>2</sub>O<sub>3</sub> and 3-15 wt% ZnO, wherein the wt% are based on the total weight of the vanadium-phosphorus-antimony-zinc-based-oxide; and(c) an organic vehicle, wherein the silver and the vanadium-phosphorus-antimony-zinc-based-oxide are dispersed in the organic vehicle and a metal-wrap-through silicon solar cell with an n-type or a p-type silicon base comprising the fired conductive silver paste of any of claims 1-4.

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## 2. claims: 6-10

A conductive silver paste comprising:(a) silver;(b) a tellurium-boron-phosphorus-based-oxide comprising 80-95 wt% TeO<sub>2</sub> , 1-10 wt% B<sub>2</sub>O<sub>3</sub> and 1-10 wt% P<sub>2</sub>O<sub>5</sub> , wherein the wt% are based on the total weight of the tellurium-boron-phosphorus-based-oxide; and(c) an organic vehicle, wherein the silver and the tellurium-boron-phosphorus-based-oxide are dispersed in the organic vehicle and a metal-wrap-through silicon solar cell with an n-type or a p-type silicon base comprising the fired conductive silver paste of any of claims 6-9.

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## 3. claims: 11-14

A conductive silver paste comprising:(a) silver;(b) a tellurium-molybdenum-cerium-based-oxide comprising 45-65 wt% TeO<sub>2</sub> , 20-35 wt% MoO<sub>3</sub> and 10-25 wt% CeO<sub>2</sub> , wherein the wt% are based on the total weight of the tellurium-molybdenum-cerium-based-oxide; and(c) an organic vehicle, wherein the silver and the tellurium-molybdenum-cerium-based-oxide are dispersed in the organic vehicle and a metal-wrap-through silicon solar cell with an n-type or a p-type silicon base comprising the fired conductive silver paste of any of claims 11-13.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2014/014553
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