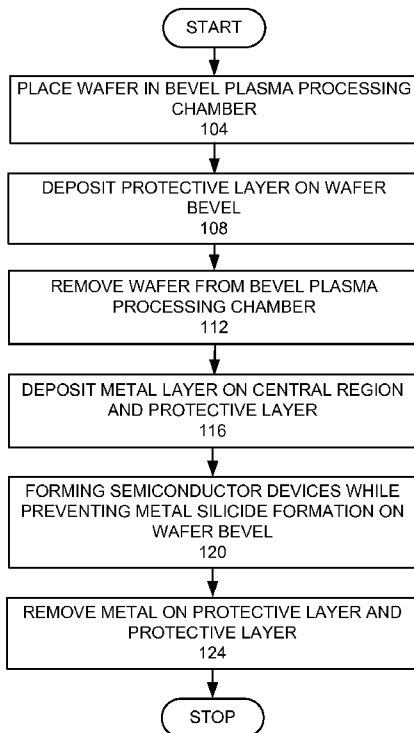




- (51) International Patent Classification: *H01L 21/3065* (2006.01)
- (21) International Application Number: PCT/US2012/036018
- (22) International Filing Date: 1 May 2012 (01.05.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 13/102,923 6 May 2011 (06.05.2011) US
- (71) Applicant (for all designated States except US): **LAM RESEARCH CORPORATION** [US/US]; 4650 Cushing Parkway, Fremont, California 94538 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **FISCHER, Andreas** [US/US]; 18989 Mount Lassen Drive, Castro Valley, California 94552 (US). **BASS, William Scott** [US/DE]; Hauptstrasse 28, 01045 Wachau (DE).
- (74) Agents: **LEE, Michael** et al.; Beyer Law Group LLP, P.O. Box 1687, Cupertino, California 95015-1687 (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, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,

[Continued on next page]

(54) Title: MITIGATION OF SILICIDE FORMATION ON WAFER BEVEL



(57) Abstract: A method for preventing formation of metal silicide material on a wafer bevel is provided, where the wafer bevel surrounds a central region of the wafer. The wafer is placed in bevel plasma processing chamber. A protective layer is deposited on the wafer bevel. The wafer is removed from the bevel plasma processing chamber. A metal layer is deposited over at least part of the central region of the wafer, wherein part of the metal layer is deposited over the protective layer. Semiconductor devices are formed while preventing metal silicide formation on the wafer bevel.

FIG. 1

WO 2012/154454 A3

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, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

**Published:**

- 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:**

24 January 2013

**A. CLASSIFICATION OF SUBJECT MATTER*****H01L 21/3065(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 21/3065; H01L 21/324; H01L 21/28; H01L 27/108; H01L 21/8242; H01L 27/082; H01L 21/31; H01L 21/316; H01L 27/04

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) &amp; Keywords:'silicide, wafer bevel, protective layer, silicon dioxide'

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                   | Relevant to claim No.                |
|-----------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Y         | US 2010-0248463 A1 (LETZ TOBIAS et al.) 30 September 2010<br>See figures 1a-1g; paragraphs [0026]~[0033]             | 1-22,24                              |
| Y         | KR 10-2006-0061705 A (HYNIX SEMICONDUCTOR INC.) 08 June 2006<br>See figures 2a-4; page 3, line 13~page 4, line 6     | 1-22,24                              |
| Y<br>A    | KR 10-1999-0076400 A (SAMSUNG ELECTRONICS CO., LTD.) 15 October 1999<br>See page 6, line 18~39                       | 7-9, 18, 19<br>1-6, 10-17, 20-22, 24 |
| A         | US 2007-0264822 A1 (TAKEO KUBOTA et al.) 15 November 2007<br>See figures 15-30; paragraphs [0060]~[0068]             | 1-22,24                              |
| A         | KR 10-2006-0105851 A (HYNIX SEMICONDUCTOR INC.) 11 October 2006<br>See figures 2-15; page 3, line 31~page 7, line 22 | 1-22,24                              |
| A         | KR 10-2000-0066975 A (SAMSUNG ELECTRONICS CO., LTD.) 15 November 2000<br>See page 2, line 57~line 60                 | 1-22,24                              |

 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

30 NOVEMBER 2012 (30.11.2012)

Date of mailing of the international search report

**30 NOVEMBER 2012 (30.11.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan  
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KOO, Bon Jae

Telephone No. 82-42-481-8225



**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.: 28, 29  
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:  
The claims have been drafted as dependent claims on multiple dependent claims.
  
3.  Claims Nos.: 23, 25~27, 30~33  
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 fee, this Authority did not invite payment of any additional fee.
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/US2012/036018**

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|----------------------------------------|------------------|-------------------------|------------------|
| US 2010-0248463 A1                     | 30.09.2010       | DE 102009015749 B3      | 20.01.2011       |
| KR 10-2006-0061705 A                   | 08.06.2006       | None                    |                  |
| KR 10-1999-0076400 A                   | 15.10.1999       | None                    |                  |
| US 2007-0264822 A1                     | 15.11.2007       | JP 04-745038 B2         | 20.05.2011       |
|                                        |                  | JP 2007-150185 A        | 14.06.2007       |
|                                        |                  | US 7638439 B2           | 29.12.2009       |
| KR 10-2006-0105851 A                   | 11.10.2006       | None                    |                  |
| KR 10-2000-0066975 A                   | 15.11.2000       | JP 03-270835 B2         | 18.01.2002       |
|                                        |                  | JP 2000-315781 A        | 14.11.2000       |
|                                        |                  | TW 449776 B             | 11.08.2001       |
|                                        |                  | US 06162675 A           | 19.12.2000       |
|                                        |                  | US 6326669 B1           | 04.12.2001       |