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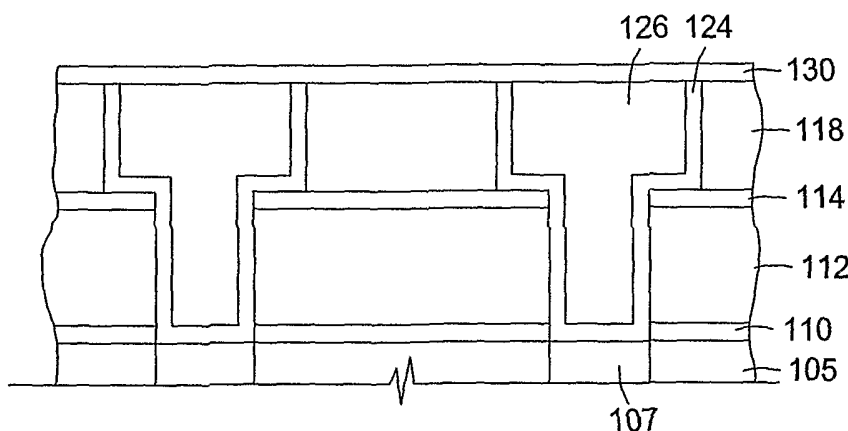
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(54) Title: ADHESION IMPROVEMENT FOR DIELECTRIC LAYERS TO CONDUCTIVE MATERIALS



(57) Abstract: Methods are provided for processing a substrate for depositing an adhesion layer between a conductive material and a dielectric layer. In one aspect, the invention provides a method for processing a substrate including positioning a substrate having a conductive material disposed on a substrate surface, exposing the substrate surface to a reducing compound, a silicon based compound, or both, reacting at least a portion of the substrate surface with the reducing compound, the silicon based compound, or both, and

depositing a silicon carbide layer without breaking vacuum.

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2005/013313

## A. CLASSIFICATION OF SUBJECT MATTER

H01L21/768 H01L21/314 H01L21/318 C23C16/32 C23C16/42  
H01L23/532

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 C23C

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 practical, search terms used)

EPO-Internal, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 390 742 A (* AGERE SYSTEMS INC) 14 January 2004 (2004-01-14)	1,2,4,5
Y	the whole document	6-9
Y	----- US 2004/067308 A1 (ZHENG YI ET AL) 8 April 2004 (2004-04-08) paragraph [0011] - paragraph [0075]	6
Y	----- US 2002/119250 A1 (CAMPANA FRANCIMAR ET AL) 29 August 2002 (2002-08-29) paragraph [0036] - paragraph [0043]	7
Y	----- US 5 447 887 A (FILIPIAK ET AL) 5 September 1995 (1995-09-05) column 4, line 28 - column 5, line 54; table 1	8,9
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document but published on or after the international filing date

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"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

14 October 2005

Date of mailing of the international search report

29 NOV. 2005

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2005/013313

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>HYMES S ET AL: "Thermal stability of copper silicide passivation layers in copper-based multilevel interconnects" JOURNAL OF APPLIED PHYSICS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 83, no. 8, 15 April 1998 (1998-04-15), pages 4507-4512, XP012045059 ISSN: 0021-8979 page 4507</p> <p>-----</p>	1

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2005/013313

## Box 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 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 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.:

1,2,4-12

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ 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: 1,2,4-12

Method of forming a silicide layer of a conductive material on a substrate and depositing a silicon carbide layer on the silicide layer.

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2. claims: 3,13-30

Method of forming a silicide layer of a conductive material on a substrate and depositing a silicon nitride layer and a silicon carbide layer thereon.

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3. claims: 31-38

Method of exposing a conductive material on a substrate to a plasma comprising nitrogen and hydrogen, and depositing a double barrier layer of nitrogen doped silicon carbide and silicon carbide thereon.

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4. claims: 39-47

Method of exposing a conductive material on a substrate to a plasma comprising nitrogen and hydrogen and depositing a barrier layer, whereby said step of exposing is terminated before initiating deposition of a barrier layer comprising nitrogen doped silicon carbide.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date		Patent family member(s)	Publication date
GB 2390742	A	14-01-2004	JP	2003347302 A	05-12-2003
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US 5447887	A	05-09-1995	NONE		