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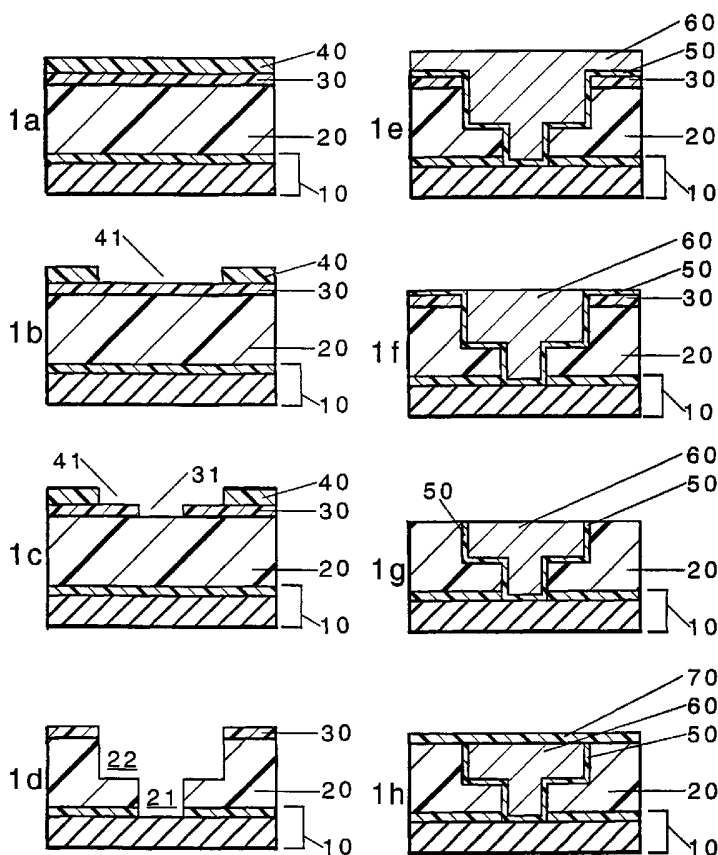
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(54) Title: ORGANOSILICATE RESINS AS HARDMASKS FOR ORGANIC POLYMER DIELECTRICS IN FABRICATION OF MICROELECTRONIC DEVICES



(57) Abstract: This invention is a method comprising providing a substrate, forming a first layer on the substrate, wherein the first layer has a dielectric constant of less than 3.0 and comprises an organic polymer, applying an organosilicate resin over the first layer, removing a portion of the organosilicate resin to expose a portion of the first layer, and removing the exposed portions of the first layer. The invention is also an integrated circuit article comprising an active substrate containing transistors and an electrical interconnect structure containing a pattern of metal lines separated, at least partially, by layers or regions of an organic polymeric material having a dielectric constant of less than 3.0 and further comprising a layer of an organosilicate resin above at least one layer of the organic polymer material.



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

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27 December 2002

## INTERNATIONAL SEARCH REPORT

In ☐ national Application No

PCT/US 01/25977

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L21/312 C09D183/06 H01L21/311

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)

IPC 7 H01L C09D

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, CHEM ABS Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WEIDMAN T W ET AL: "NEW PHOTODEFINABLE GLASS ETCH MASKS FOR ENTIRELY DRY PHOTOLITHOGRAPHY: PLASMA DEPOSITED ORGANOSILICON HYDRIDE POLYMERS" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 62, no. 4, 25 January 1993 (1993-01-25), pages 372-374, XP000335996 ISSN: 0003-6951 abstract ---	7,9
X	EP 0 466 025 A (NIPPON TELEGRAPH & TELEPHONE) 15 January 1992 (1992-01-15) abstract --- -/--	7,9

☒ 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
- \*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

18 July 2002

Date of mailing of the international search report

25. 07. 2002

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/25977

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

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 42 18 495 A (MITSUBISHI ELECTRIC CORP) 10 December 1992 (1992-12-10) page 7, line 50-55 ----	1-3
A	US 4 043 953 A (CHANG WEN-HSUAN ET AL) 23 August 1977 (1977-08-23) the whole document ----	1-3
A	WO 00 18847 A (CATALYSTS & CHEM IND CO ; EGAMI MIKI (JP); KOMATSU MICHIO (JP); NAK) 6 April 2000 (2000-04-06) & EP 1 035 183 A (CATALYSTS & CHEMICALS INDUSTRIES CO.) 13 September 2000 (2000-09-13) abstract ----	1-3
P, A		1-3
A	MAISONOBE J C ET AL: "SILK compatibility with the IMD process using copper metallization" MICROELECTRONIC ENGINEERING, ELSEVIER PUBLISHERS BV., AMSTERDAM, NL, vol. 50, no. 1-4, January 2000 (2000-01), pages 25-32, XP004237646 ISSN: 0167-9317 the whole document -----	7

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 01/25977

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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.:

### 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: 1-6,25,26

Composition comprising siloxane

The prior Art DE218495 describes the synthesis of a siloxane polymer by reacting phenyltrichlorosilane and vinyltrichlorosilane with water (hydrolysis) and thus forming a siloxane type polymer.

The new features mentioned in claims 1-6,25,26 are fabrication of a composition by reacting an alkoxy (or acyloxy) silane having at least one unsaturated nonaromatic hydrocarbon group directly attached to the Si atom (e.g. vinyltriethoxysilane) and an alkoxy (or acyloxy) silane having at least one aromatic hydrocarbon group directly attached to the Si atom (e.g. Phenyltrimethoxy silane) with water.

The special technical features, as defined in Rule 13(2) PCT, are the synthesis of the new composition by reacting an alkoxy (or acyloxy) silane having at least one unsaturated nonaromatic hydrocarbon group directly attached to the Si atom (e.g. vinyltriethoxysilane) and an alkoxy (or acyloxy) silane having at least one aromatic hydrocarbon group directly attached to the Si atom (e.g. Phenyltrimethoxy silane) with water.

2. Claims: 7-24

Etching of holes or trenches

The prior Art DE218495 describes the synthesis of a siloxane polymer by reacting phenyltrichlorosilane and vinyltrichlorosilane with water (hydrolysis) and thus forming a siloxane type polymer.

The new features mentioned in claims 7-24 are the etching of holes or trenches in a dielectric layer using a mask.

The objective problem is to etch holes or trenches in a dielectric layer using a mask.

The special technical features, as defined in Rule 13(2) PCT, are the etching of holes or trenches in a dielectric layer using a mask.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/25977

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