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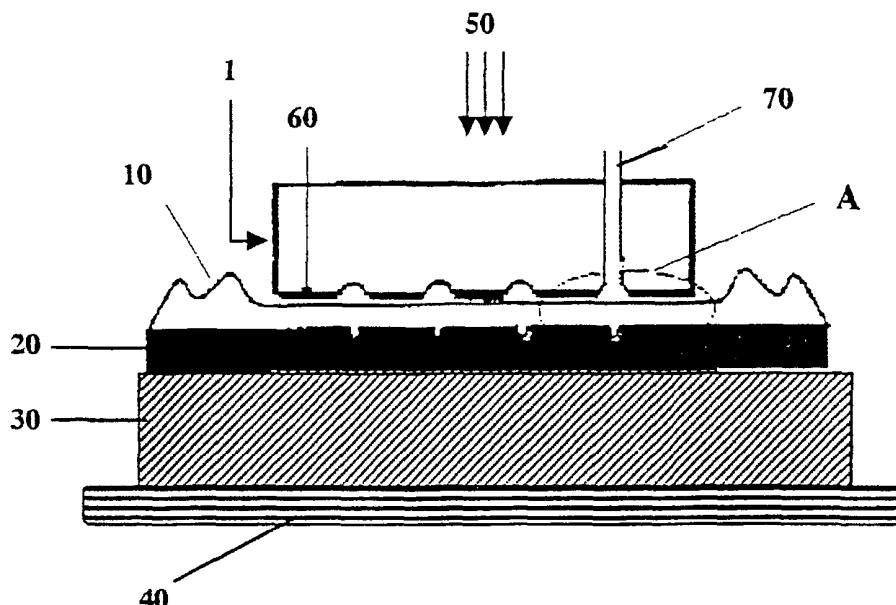
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[Continued on next page]

(54) Title: IMPROVED APPARATUS AND METHODS FOR INTEGRATED CIRCUIT PLANARIZATION



(57) Abstract: An apparatus for planarizing or patterning a dielectric film on a substrate is provided. The apparatus includes a press for applying contact pressure to an operably connected compression tool. The compression tool has a working face that is planar or patterned. A controller for regulating the position, timing and force applied by the compression tool to the dielectric film is also provided. There is also provided a support, with an optional workpiece holder for supporting the substrate and dielectric film during contact with the compression tool. Methods of using the apparatus, as well as planarized and/or patterned dielectric films are also provided.



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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/24847

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 H01L21/3105 G03F7/00 B44B5/02

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 G03F B44B

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)

PAJ, EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 643 (E-1640), 7 December 1994 (1994-12-07) & JP 06 252113 A (MATSUSHITA ELECTRIC IND CO LTD), 9 September 1994 (1994-09-09)	1-4, 8, 12
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Y	abstract	14
X	WO 95 11521 A (DOBSON) 27 April 1995 (1995-04-27)	1-3, 6, 8, 12
Y	abstract	11
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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
- \*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)
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- \*&\* document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/24847

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	"DEVICE FOR PLANARIZING STRUCTURED SURFACES" IBM TECHNICAL DISCLOSURE BULLETIN, US, IBM CORP. NEW YORK, vol. 32, no. 5A, 1 October 1989 (1989-10-01), pages 402-403, XP002021196 ISSN: 0018-8689 page 403, last paragraph ---	11
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X	US 5 736 424 A (PRYBYLA ET AL) 7 April 1998 (1998-04-07) cited in the application figure 3 ---	1-3,5,6, 8,11,14
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X	KRUG H ET AL: "FINE PATTERNING OF THIN SOL-GEL FILMS" JOURNAL OF NON-CRYSTALLINE SOLIDS,NL,NORTH-HOLLAND PHYSICS PUBLISHING. AMSTERDAM, vol. 147/148, 1 October 1992 (1992-10-01), pages 447-450, XP000398432 ISSN: 0022-3093 page 447, right-hand column, paragraph 2 -page 449 ---	17-19,23
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# INTERNATIONAL SEARCH REPORT

Int. .ional Application No

PCT/US 00/24847

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 212 (P-224), 20 September 1983 (1983-09-20) & JP 58 105444 A (TOPPAN INSATSU KK), 23 June 1983 (1983-06-23) abstract ---	7
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X	RONCONE R L ET AL: "EMBOSSSED GRATINGS IN SOL-GEL WAVEGUIDES: PRE-EMBOSS HEAT TREATMENT EFFECTS" JOURNAL OF NON-CRYSTALLINE SOLIDS,NL,NORTH-HOLLAND PHYSICS PUBLISHING. AMSTERDAM, vol. 128, no. 2, 1 April 1991 (1991-04-01), pages 111-117, XP000206674 ISSN: 0022-3093 abstract ---	14,18-20
X	HAISMA J ET AL: "MOLD-ASSISTED NANOLITHOGRAPHY: A PROCESS FOR RELIABLE PATTERN REPLICATION" JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY: PART B,US,AMERICAN INSTITUTE OF PHYSICS. NEW YORK, vol. 14, no. 6, 1 November 1996 (1996-11-01), pages 4124-4128, XP000721137 ISSN: 0734-211X figures -----	7

# INTERNATIONAL SEARCH REPORT

international application No.  
PCT/US 00/24847

## 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:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
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:

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**

Continuation of Box I.2

Claims 18-24 are unclear (Art. 6 PCT) as to the category of the claims. This unclarity is such to render a complete meaningful search impossible. Accordingly the Searching Authority decided to limit the search to a process of forming a planarized or patterned coating.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

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

1. Claims: 1-6,8,11,12,14-24

An apparatus comprising a press, a compression tool, a controller and a support. A method of planarizing or patterning a dielectric film.

An apparatus as above wherein the compression tool is divided in several compression tools.

2. Claim : 7

An apparatus for planarizing or patterning a film maintained in convex shape to improve the contact between the film and the compression tool.

3. Claims: 9, 10, 13

An apparatus for planarizing or patterning a film comprising a compression tool provided with vents to release gases located between the compression tool and the substrate.



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/24847

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