



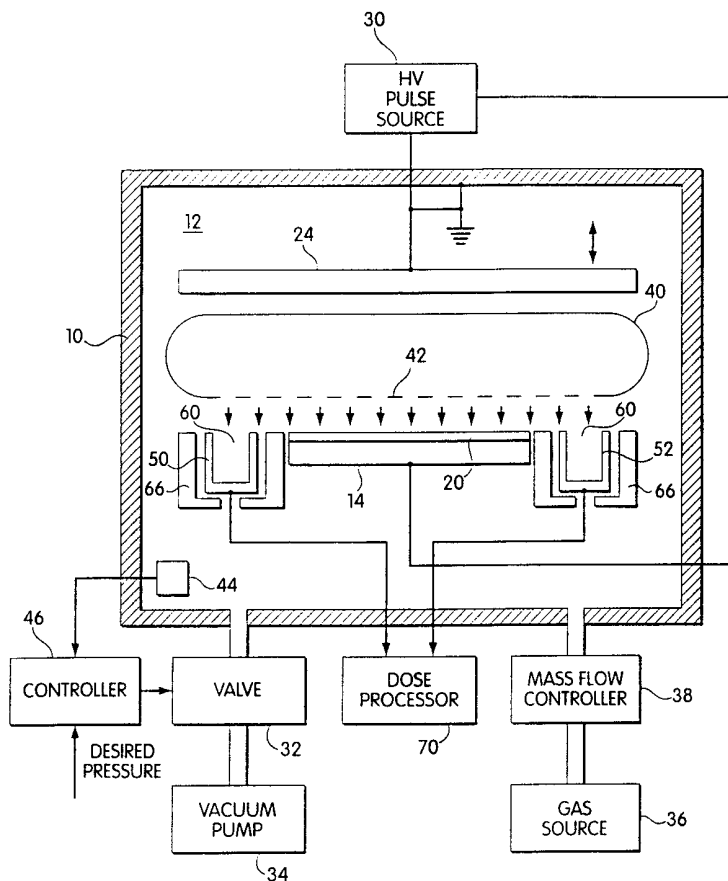
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(54) Title: DOSE MONITOR FOR PLASMA-MONITOR ION IMPLANTATION DOPING SYSTEM

(57) Abstract

Plasma doping apparatus includes a plasma doping chamber, a platen mounted in the plasma doping chamber for supporting a workpiece such as a semiconductor wafer, a source of ionizable gas coupled to the chamber, an anode spaced from the platen and a pulse source for applying high voltage pulses between the platen and the anode. The high voltage pulses produce a plasma having a plasma sheath in the vicinity of the workpiece. The high voltage pulses accelerate positive ions across the plasma sheath toward the platen for implantation into the workpiece. The plasma doping apparatus includes at least one Faraday cup positioned adjacent to the platen for collecting a sample of the positive ions accelerated across the plasma sheath. The sample is representative of the dose of positive ions implanted into the workpiece.



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INTERNATIONAL SEARCH REPORT

International Application No

PC JS 99/15790

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01J37/32 C23C14/48

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 H01J 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 354 381 A (SHENG TERRY T) 11 October 1994 (1994-10-11) abstract column 3, line 5 -column 4, line 45 figures 1,2	1,17,19, 28,36
Y	EP 0 532 283 A (SHARP KK) 17 March 1993 (1993-03-17) abstract column 4, line 52-58 figure 1	1,17,19, 28,36
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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"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

16 December 1999

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PC., JS 99/15790

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 021 675 A (SHIFRIN GORDON A) 3 May 1977 (1977-05-03) abstract column 3, line 6-38; figures 1-3 ---	1,17,19, 28,36
A	US 5 653 811 A (CHAN CHUNG) 5 August 1997 (1997-08-05) abstract column 3, line 1-4,53-67; claims 7-9 figure 1 -----	1,17,19, 28,36

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 99/ 15790

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:

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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 99/15790

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

1. Claims: 1, 17, 19-21, 28, 36

Plasma doping apparatus; Method for monitoring a dose. Wafer support (claim 17).

2. Claim : 2

Faraday cup and platen at equal electric potentials

3. Claim : 3

Details of a mask

4. Claim : 4

Faraday cup is coplanar with the workpiece

5. Claims: 5, 29, 37

A plurality of Faraday cups around a platen.

6. Claims: 6, 30, 38

Annular Faraday cup

7. Claims: 7, 26, 33

One Faraday cup within one guard ring

8. Claims: 8, 25

Plurality of Faraday cups within one guard ring

9. Claim : 9

annular Faraday cup at same potential as the guard ring

10. Claims: 10, 22, 31

A Faraday cup comprising a dose processing circuit for integrating a current.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 99/15790

11. Claims: 11, 23, 32

Plurality of Faraday cups comprising a dose uniformity circuit.

12. Claims: 12, 24, 35, 40

Additional electrode for suppressing escape of secondary electrons/ hollow cathode discharge.

13. Claim : 13

One additional magnet

14. Claim : 14

Lateral dimension of the Faraday cup, geometric configuration (not clear, captured in terms of a result to be achieved).

15. Claims: 15, 16

Chamber with electrically conductive walls, at common electric potential with the anode.

16. Claims: 18, 27, 40

Details of a Faraday cup comprising:
entrance aperture plate
ion collector plate
secondary electron collector ring
biasing means.

In claim 27 the biasing step has been omitted leading to unclarity as having regard to the result to be achieved:
"...preventing secondary electrons formed at the ion collector plate from moving toward the entrance aperture".

17. Claim : 34

pressure control system

18. Claim : 39

Faraday cup embedded within a guard ring.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ 99/15790

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