

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 14

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHUN YAN, YAN YE
and DIANA XIAOBING MA

Appeal No. 2002-1642
Application 09/300,563

ON BRIEF

Before FRANKFORT, MCQUADE, and BAHR, Administrative Patent Judges.

MCQUADE, Administrative Patent Judge.

DECISION ON APPEAL

Chun Yan et al. appeal from the final rejection of claims 1 through 6, 10 and 11. Claims 7 through 9, 12 and 14, the only other claims pending in the application, stand allowed.¹

¹ Claim 12, which depends from claim 11, should stand objected to as depending from a rejected base claim.

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THE INVENTION

The invention relates to a method and apparatus for processing semiconductor wafers. Representative claims 1 and 10 read as follows:

1. A method for processing a workpiece in a chamber having a plurality of gas nozzles, comprising the steps of:
selectively opening a first number of the plurality of gas nozzles while selectively blocking a second number of the plurality of gas nozzles;
introducing an asymmetric flow of process gas to the chamber through said selectively opened first number of gas nozzles; and
processing the workpiece with said process gas.

10. Apparatus for processing a workpiece, comprising:
a processing chamber having a wall;
a pump port, communicating through said wall;
one or more gas nozzles selectively opened and one or more gas nozzles selectively blocked, said gas nozzles communicating through said wall, and said gas nozzles being located mostly proximate said pump port.

THE REJECTION

Claims 1 through 6, 10 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,449,411 to Fukuda et al. (Fukuda).

Attention is directed to the appellants' main and reply briefs (Paper Nos. 10 and 12) and to the examiner's answer (Paper No. 11) for the respective positions of the appellants and the examiner with regard to the merits of this rejection.

DISCUSSION

Fukuda discloses "a method and apparatus for processing a substrate by use of plasma, and particularly to a technique that is suitable for a microwave plasma CVD [chemical vapor deposition] apparatus for forming a thin film on a substrate" (column 1, lines 6 through 9). As described in the reference,

FIG. 2 shows the cross section of the principal portions of the microwave plasma processing apparatus based on the first embodiment of this invention. The apparatus comprises a vacuum chamber 5 having a window 4 which transmits a microwave 3, a cylindrical substrate holder 2 disposed at the bottom of the vacuum chamber beneath the window 4, reactive gas conduits 6 and 7 for feeding substrate processing gases into the vacuum chamber, a cleaning gas conduit 8 for feeding a cleaning gas into the vacuum chamber, a gas evacuation port 9 formed in the wall of the vacuum chamber, an electromagnetic winding 10 disposed near the window 4 outside the vacuum chamber 5 for producing a magnetic field in the vacuum chamber, and a high-frequency power source 12 connected to the substrate holder 2.

. . .
This apparatus was used to form a SiO₂ film on the substrate 1 by feeding SiH₄ gas at 20 ml/min and O₂ gas at 200 ml/min into the vacuum chamber 5 through the reactive gas conduits 6 and 7, evacuating the vacuum chamber to 0.3 Pa, applying a magnetic flux at a flux density of 875 gauss or more produced by the electromagnetic winding in a direction substantially normal to the substrate, and applying a microwave of 600 W. After microwave application of five minutes, a SiO₂ film with a thickness of 1 μm was formed on the substrate. . . .

After the substrate 1 with the SiO₂ film being formed thereon was taken out, the vacuum chamber was cleaned (etched) by feeding C₂F₆ gas through the cleaning gas conduit 8 in place of the reactive gases previously fed through reactive gas conduits 7 and 8

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[sic, 6 and 7], and applying the same microwave for five minutes to generate plasma [column 4, line 34, through column 5, line 12]

The appellants contend that Fukuda would not have rendered the subject matter recited in claims 1 through 3 and 10 obvious within the meaning of § 103(a) because it is silent as to the manner in which the processing gases are introduced into the chamber and thus non-responsive to the gas feeding limitations in these claims.

Fukuda, however, clearly shows in Figure 2 that the gases for processing substrate 1 are separately introduced into the chamber 5 via two conduits 6 and 7 located on the same side of the chamber just above the gas evacuation port 9 and that the cleaning gas is separately introduced into the chamber 5 via a third conduit 8 also located just above the gas evacuation port. Fukuda additionally teaches that when the conduits 6 and 7 are simultaneously opened to feed the processing gases into the chamber, the conduit 8 is closed or blocked. This disclosure would have suggested, if it does not actually teach, the step of selectively opening a first number of a plurality of gas nozzles (the ends of Fukuda's processing gas conduits 6 and 7) while selectively blocking a second number of the plurality of gas nozzles (the end of Fukuda's cleaning gas conduit 8) as recited

in claim 1. Moreover, the appellants have not cogently explained, nor is it apparent, (1) why such introduction of the processing gases into Fukuda's chamber would not inherently produce an "asymmetric flow" in the sense disclosed in the appellants' specification and broadly recited in claim 1, (2) why the processing gases are not introduced into the chamber via nozzles "proximate" a pump port (Fukuda's gas evacuation port 9) to the extent disclosed in the appellants' specification and broadly recited in claim 3, (3) why the asymmetric flow would not inherently "counteract" a non-uniform distribution of reactive species and by products in the chamber as disclosed in the appellants' specification² and broadly recited in claim 2, or (4) why Fukuda's nozzles (the ends of conduits 6, 7 and 8) are not "located mostly proximate" a pump port (Fukuda's gas evacuation port 9) as broadly recited in claim 10.

Hence, on its face Fukuda would have suggested, if it does not actually teach, a processing method and apparatus responsive to the argued limitations in claims 1 through 3 and 10. We shall

² The appellants' specification (see, for example, pages 2, 5 and 6) explains that the asymmetric flow counteracts non-uniform distribution of reactive species and by products by introduction into the chamber primarily through nozzles located near or proximate the pump port.

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therefore sustain the standing 35 U.S.C. § 103(a) rejection of these claims as being unpatentable over Fukuda.

We also shall sustain the standing 35 U.S.C. § 103(a) rejection of dependent claims 4, 5 and 11 since the appellants, allowing these claims to stand or fall with their respective parent claims 1 and 10 (see pages 13, 16 and 17 in the main brief), have not disputed the merits thereof.

We shall not sustain, however, the standing 35 U.S.C. § 103(a) rejection of claim 6 as being unpatentable over Fukuda. Claim 6 depends from claim 1 and further defines the workpiece processing step set forth in the parent claim as including "an etch process." The examiner has failed to point out, and it is not evident, how or why Fukuda teaches or would have suggested processing the workpiece, i.e., substrate 1, with an etching process.³

SUMMARY

The decision of the examiner to reject claims 1 through 6, 10 and 11 is affirmed with respect to claims 1 through 5, 10 and 11, and reversed with respect to claim 6.

³ The etching process disclosed by Fukuda occurs during the chamber cleaning phase after the substrate 1 has been removed from the chamber.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART

CHARLES E. FRANKFORT)	
Administrative Patent Judge)	
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)	APPEALS AND
JOHN P. MCQUADE)	
Administrative Patent Judge)	INTERFERENCES
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JENNIFER D. BAHR)	
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