

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. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MING JANG HWANG, KEIZO HOSODA,
SHINTARO AOYAMA, TADASHI TERASAKI and TSUYOSHI TAMARU

Appeal No. 2002-1178
Application No. 09/354,459

ON BRIEF

Before HAIRSTON, GROSS, and BARRY, Administrative Patent Judges.
HAIRSTON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal of claims 1 through 4, 6 through 8 and 21 through 28.

The disclosed invention relates to a method of reducing by-product deposition inside a wafer processing chamber by introducing a heated gas into the chamber concurrently with the introduction of reactant gases into the chamber to maintain the inner wall of the chamber at a temperature sufficiently high to maintain a reaction product formed by the reactant gases in a gaseous phase of the sublimation curve for the reaction product when contacting the inner wall.

Claim 1 is the only independent claim on appeal, and it reads as follows:

1. A method of reducing by-product deposition inside wafer processing equipment, comprising:

providing a chamber having a peripheral inner wall;

placing a semiconductor wafer within the chamber;

providing a plurality of reactant gases;

introducing said plurality of reactant gases into the chamber and reacting the gases to form a reaction product having a solid and a gaseous phase, said solid phase being present at known pressure/ temperature levels in relation to a known sublimation curve for said reaction product;

providing a heated gas; and

introducing said heated gas into the chamber concurrently with said step of introducing a plurality of reactant gases into the chamber to maintain the peripheral inner wall at a temperature sufficiently high to maintain said reaction product in the gaseous phase of said sublimation curve when contacting the peripheral inner wall.

The references relied on by the examiner are:

Mikoshiha et al. (Mikoshiha)	4,989,541	Feb. 5, 1991
Ohashi et al. (Ohashi)	6,059,885	May 9, 2000 (filed Dec. 16, 1997)
Nozaki et al. (Nozaki) (Japanese Patent Application)	61-117824 ¹	June 5, 1986

Pierson, "Handbook of Chemical Vapor Deposition (CVD)," Noyes Publications (1992), pages 222 through 226.

¹ A copy of the translation of this reference is attached.

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Claims 4 and 24 stand rejected under the second paragraph of 35 U.S.C. § 112 as indefinite because hydrogen chloride is claimed as a reactant gas that is introduced into the chamber as opposed to a by-product gas produced from the reaction of the reactant gases.

Claims 1 through 3, 6 through 8, 21 through 23 and 25 through 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikoshiba in view of Nozaki.

Claims 1 through 3, 6 through 8, 21 through 23 and 25 through 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohashi in view of Nozaki.

Claims 4 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikoshiba in view of Nozaki, appellants' admitted prior art and Pierson, or Ohashi in view of Nozaki, appellants' admitted prior art and Pierson.

Reference is made to the second supplemental brief and reply brief (paper numbers 15 and 17) and the answer (paper number 16) for the respective positions of the appellants and the examiner.

OPINION

We have carefully considered the entire record before us, and we will sustain the indefiniteness rejection of claims 4 and 24, and reverse the obviousness rejections of claims 1 through 4, 6 through 8 and 21 through 28.

Turning first as we must to the indefiniteness rejection, appellants argue (reply brief, pages 2 and 3) that:

The fact that hydrogen chloride is stated to be reacted with ammonia (page 2, lines 10 and 11) indicates that reactant gases introduced into the chamber can include these gases. Furthermore, some of the class of possible reactant gases is clearly set forth in the paragraph bridging pages 7 and 8 of the specification as reactant gases 22 and these gases specifically include ammonia and hydrogen chloride among other gases.

Appellants' arguments to the contrary notwithstanding, the examiner correctly concludes (answer, page 6) that:

. . . HCl is **not** one of the plurality of reactant gases **introduced** into the reaction chamber, as presently claimed, but is instead a **by-product** of the reaction of the reactant gases fed into the chamber -- specifically of ammonia and chlorine-containing reactants. One of ordinary skill knows from Applicant's [sic, Applicants'] specification that HCl is **not** introduced to the reaction chamber but is, instead, **formed within the chamber as a by-product, itself**, that goes on to react with more ammonia to produce the undesired-but-unavoidable ammonium chloride . . .

Inasmuch as hydrogen chloride is not introduced into the chamber as a reactant gas, claims 4 and 24 are rendered indefinite by the claim limitation that hydrogen chloride is one of the plurality of reactant gases introduced into the chamber. As a result thereof, the indefiniteness rejection of claims 4 and 24 is sustained.

In claim 1 on appeal, the heated gas introduced into the chamber maintains the peripheral inner wall of the chamber at a temperature sufficiently high to maintain the reaction product in the gaseous phase of its sublimation curve when contacting the peripheral inner wall. In Mikoshiba, the control gas 8 from nozzle 6 functions to keep the material gas flow from ever touching the peripheral inner wall of the chamber 1 (Figure 1A; column 2, lines 19 through 23, 40 and 41; column 4, lines 10 through 14; column 5, lines 1 through 3 and 21 through 26). By relying on the

heated gas teachings of Nozaki, the examiner tacitly admits (answer, pages 8 and 9) that the control gas 8 in Mikoshiba is not a heated gas. Although Nozaki introduces a heated carrier gas into the chamber 7 via supply port 23, Nozaki, like Mikoshiba, uses the heated gas to prevent the reaction gas from coming into contact with the side walls of the chamber (translation, page 5). Even if the reactant gases in Mikoshiba and Nozaki are maintained on the gaseous sides of their respective sublimation curves, as argued by the examiner (answer, pages 9 and 10), neither Mikoshiba nor Nozaki teaches or would have suggested to the skilled artisan maintaining “said reaction product in the gaseous phase of said sublimation curve when contacting the peripheral inner wall.” Thus, the obviousness rejection of claims 1 through 3, 6 through 8, 21 through 23 and 25 through 28 is reversed.

In the alternative rejection of claims 1 through 3, 6 through 8, 21 through 23 and 25 through 28, Ohashi, like Mikoshiba and Nozaki, does not want the reactant gas to contact the inner wall of the chamber (column 12, lines 65 through 67; column 15, lines 35 through 38). The examiner acknowledges (answer, page 12) that Ohashi does not disclose the claimed heated gas. Thus, the obviousness rejection of claims 1 through 3, 6 through 8, 21 through 23 and 25 through 28 is reversed because the reactant gases in the references do not contact the “peripheral inner wall” of either chamber.

The obviousness rejections of claims 4 and 24 are reversed because neither the admitted prior art nor the teachings of Pierson cure the noted shortcomings in the teachings of Mikoshiba, Nozaki and Ohashi.

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DECISION

The decision of the examiner rejecting claims 4 and 24 under the second paragraph of 35 U.S.C. § 112 is affirmed, and the decision of the examiner rejecting claims 1 through 4, 6 through 8 and 21 through 28 under 35 U.S.C. § 103(a) is reversed. Accordingly, the decision of the examiner is affirmed-in-part.

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

KENNETH W. HAIRSTON)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
ANITA PELLMAN GROSS)	APPEALS
Administrative Patent Judge)	AND
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