

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. 27

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* ELLIE YIEH, PAUL GEE, LI-QUN XIA,  
FRANCIMAR CAMPANA, SHANKAR VENKATARANAN,  
DANA TRIBULA and BANG NGUYEN

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Appeal No. 2000-0037  
Application 08/627,631<sup>1</sup>

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ON BRIEF

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Before METZ, KRATZ and JEFFREY SMITH, *Administrative Patent Judges*.

METZ, *Administrative Patent Judge*.

*DECISION ON APPEAL*

This is an appeal under 35 U.S.C. § 134 from the examiner's refusal to allow claims 1 through 36, all the claims remaining in this application.

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Application for patent filed April 4, 1996.

**THE INVENTION**

The appealed subject matter is directed to a method for forming a dielectric film on a substrate. According to appellants, the claimed method is useful in the fabrication of semiconductor devices. Appellants allege that compared to conventional prior art methods, the claimed method achieves higher deposition rates and less downstream apparatus contamination than prior art methods. Additionally, appellants allege that the dielectric layers which are laid down have improved film uniformity, superior gap fill/reflow capability and smoother surface morphology than dielectric layers prepared by the prior art methodology.

Claims 1, 14 and 25, appellants' only independent claims, are believed to be adequately representative of the appealed subject matter and are reproduced below for a more facile understanding of the claimed invention.

**1.** A method for forming a dielectric film on a substrate wherein said method produces less contamination in a substrate processing system than is formed under substantially identical processing conditions with a nitrogen carrier gas, said method comprising the steps of:

flowing a process gas containing silicon, oxygen, and first dopant atoms into the chamber to form the dielectric film at substantially said identical processing condition;

using helium as the carrier gas for at least a portion of said process gas in the system; and

processing more substrates in the system between cleanings than in a process under substantially said identical processing conditions using nitrogen as carrier gas.

**14.** A method for forming a layer on a substrate under processing conditions which require a cleaning of a substrate processing system upon depositing an accumulated deposited film thickness when using nitrogen in said system under conditions substantially similar to said processing conditions, said method comprising the steps of:

flowing a process gas containing silicon, oxygen, and dopant atoms into a substrate processing system;

flowing helium gas into said system; and

depositing an accumulated deposited film thickness of greater than said accumulated deposited film thickness of about 350  $\mu\text{m}$  on  $n$  substrates before a next cleaning of said system.

**25.** A process for forming a layer on a substrate in a reactor, said process comprising the steps of:

(a) depositing a film comprising doped silicon oxide on said substrate from a reaction of reactants including silicon, oxygen and dopant atoms, wherein said depositing step uses helium as a carrier gas, and said depositing step occurs at a pressure of between about 10-760 torr and a temperature of between about 100-750°C;

(b) processing  $n$  substrates using step (a); and

(c) cleaning said reactor after depositing an accumulated deposited film thickness on said  $n$  substrates at least 50% greater than that for a process using nitrogen carrier gas under conditions substantially similar to processing conditions comprising said reaction of said reactants at said pressure and said temperature to deposit said film on substrates.



**OPINION**

After a thorough review of the claims before us considered in light of appellants' disclosure, the prior art of record in the prosecution history and the respective positions of both the appellants and the examiner, we conclude that considerable speculation as to the meaning of the claimed method and the scope of the claims was engaged in by both the appellants and the examiner. Accordingly, we take the unusual step of summarily reversing the examiner's rejection and entering the following new ground of rejection, because the rejection was improperly founded on speculation and assumptions by both the appellants and the examiner. Compare In re Steele, 305 F.2d 859, 134 USPQ 292 (CCPA 1962).

**NEW GROUND OF REJECTION**

Pursuant to our authority under 37 C.F.R. § 1.196(b), we enter the following new ground of rejection. Claims 1 through 36 are rejected under 35 U.S.C. 112, second paragraph.

Claim 1 is directed to a method for forming a dielectric film on a substrate. According to the language recited in the preamble of claim 1, the claimed method "produces less contamination in a substrate processing system" than would be formed "under substantially identical processing conditions" but

Appeal No. 2000-0037  
Application 08/627,631

using nitrogen as a carrier gas. Thereafter, the method is described as one "comprising" the three steps of (1) flowing reactant gases "containing" silicon, oxygen and a "first dopant" into a reaction chamber to form a dielectric film "at substantially said identical processing condition", (2) using helium as the carrier gas "for at least a portion of said process gas in the system" and (3) processing more substrates in the system between cleanings than would be processed in "a process under substantially said identical processing conditions" but using nitrogen as carrier gas.

In the first instance, it strikes us that appellants are attempting to claim less a method but more the result or advantage of a method. But the method claimed is described in terms of another process without regard to the various reaction parameters which define that process. The claim language "under substantially identical processing conditions" is, apparently, a reference to the conditions utilized in the other process which uses nitrogen as a carrier gas to which appellants compare the results allegedly obtained by their process. The language "under substantially identical processing conditions" is virtually meaningless where the type of process and the nature of the conditions to which appellants' process is compared are not

Appeal No. 2000-0037  
Application 08/627,631

defined. Moreover, the use of terms of degree often, as in this instance, raise questions of definiteness under the second paragraph of the statute.

When a term of degree is used to describe a claim element we must look to the specification and determine whether the specification provides some standard for measuring that term of degree. Seattle Box Company, Inc. v. Industrial Crating & Packing, Inc., 731 F.2d 818, 826, 221 USPQ 568, 573, 574 (Fed. Cir. 1984). Thus, we look to appellants' specification to determine what are the "substantially identical processing conditions" used in the prior art processes to which appellants compare the results of their process.

At page 1 of the specification appellants disclose that their method may be used to form dielectric layers in general and premetal dielectric layers (**PMD**), intermetal dielectric layers (**IMD**), passivation layers and "other layers." According to appellants, silicon oxide films may be deposited by thermal chemical vapor deposition (**CVD**) and plasma enhanced chemical vapor deposition (**PECVD**) by reacting a silicon source with an oxygen source (see page 1, lines 16 through 29). On page 3 of their specification, appellants disclose that the prior art deposition techniques include atmospheric pressure techniques,

Appeal No. 2000-0037  
Application 08/627,631

subatmospheric pressure techniques and low pressure techniques. At page 11, line 9 through page 13, line 15, appellants disclose how to prepare a **BPSG** film on a substrate according to their invention. At page 20 of the specification the preparation of wafers using nitrogen as a carrier gas is disclosed. According to the disclosure at page 20, these wafers were prepared "according to the same recipe discussed above", an apparent reference to the description found at page 13, line 18 through page 14, line 11 for preparing a **BPSG** film.

It is apparent from mere cursory inspection of the claimed method considered in light of the above disclosure in appellants' specification that the claimed method is not limited in any fashion to any particular type of film or any particular method for forming a particular film. Indeed, the scope of appellants' claims embraces any and all prior art methods for preparing a dielectric film such as but not limited to those referenced at page 1 of the specification and which also use nitrogen as a carrier gas. Accordingly, the metes and bounds of the terminology "under substantially identical conditions" cannot be determined because it is unclear what method is being claimed. We conclude that a person having ordinary skill in the art would not have been able to ascertain at the time appellants made their

Appeal No. 2000-0037  
Application 08/627,631

invention the scope of protection defined by the claims when read in light of appellants' supporting specification. Stated another way, appellants' claims lack adequate specificity to place the public on notice of exactly what is the invention claimed by appellants.

Independent claims 14 and 25 use a slightly different phrase, that is, "under conditions substantially similar to said processing conditions" to describe the conditions used in the prior art process used to prepare prior art films to which appellants compare the properties of their film. This terminology also fails to adequately define the metes and bounds of the protection for which appellants seek a patent. What constitute prior art conditions which are "substantially similar" to the claimed conditions cannot be determined because appellants' specification does not define what appellants mean by said terminology.

Thus, nowhere in appellants' specification is the claim terminology "under substantially identical processing conditions" or "under conditions substantially similar to said processing conditions" set forth. Indeed, we are unable to determine the difference between conditions said to be "substantially identical" to prior art process conditions and those which are

Appeal No. 2000-0037  
Application 08/627,631

only "substantially similar" to prior art process conditions. There is neither an adequate description of the conditions used in the prior art method or in appellants' disclosed method found in the specification. Because the nature of the improvement over the film layer prepared by the prior art process is incorporated by appellants in their claims it is essential that appellants define the comparative process in order for the claims to have a definite meaning and scope.

On page 6 of the specification appellants disclose that their invention is simply "the use of helium instead of nitrogen as a carrier gas in a process for forming a dielectric layer such as **BPSG** to provide various unexpected results." Nevertheless, as correctly observed by the examiner in discussing the prior art on which he has relied to reject the claims before us, the use of helium in a process for forming dielectric layers is specifically described (in the sense of 35 U.S.C. § 102) by the prior art. See Lee at column 4, lines 10 through 16; lines 48 through 50; column 4, line 63 through column 5, line 2; column 5, lines 7 through 17; and claim 10. See pages 2, 7, 9 and 10 of Yamashita. See pages 11 and 12 of Hosoda. Part of the function of the requirement for claim definiteness found in the second paragraph of § 112 is to distinguish the claimed invention from what is in

Appeal No. 2000-0037  
Application 08/627,631

the prior art. See, for example, 37 C.F.R. 1.71(b). This appellants' claims fail to do.

#### **OTHER ISSUES**

In the event appellants elect further prosecution of their invention in response to the new ground of rejection, we advise the appellants and the examiner to carefully consider the relevance of U.S. Patent Number 5,000,113, issued to Wang et al., cited at page 9 of the specification and assigned to Applied Materials, Incorporated, the assignee of appellants' application in this appeal.

As described in the specification, Wang et al. discloses apparatus suitable for performing appellants' herein claimed process. Wang et al. discloses methods for preparing conformal, planar dielectric layers on IC wafers. At column 22, Wang et al. disclose that their method makes it unnecessary to dope the silicon oxide coatings but that doping at low levels by incorporating **TMP** and/or **TMB** into the reactant gas mixture containing silicon, oxygen and carrier gas is an option and that the films prepared using the dopants have "sufficient reflow characteristics." (column 22, lines 20 through 35). Doping is also recognized as effective in lowering the reflow temperature of the film. Helium is disclosed throughout Wang et al. as the

Appeal No. 2000-0037  
Application 08/627,631

sole carrier gas or in combination with other carrier gases. At column 24, lines 35 through 42, Wang et al. disclose that:

by utilizing the process according to the present invention, particularly in the apparatus disclosed in the above-identified co-pending application, the operation at high pressures (presently up to about 50 Torr) allows the plasma to be confined at the top of the substrate, thus making it less likely to contaminate the sides of the chamber and the surfaces on which deposits are not desired.

Thus, it appears that Wang et al. describes, not only the method as claimed in claim 1, for example, but also appellants' alleged advantage, that is, a cleaner reactor.

Additionally, the only films prepared by a prior art process actually disclosed and compared to appellants' films are the **BPSG** films. The scope of appellants' claims is not limited to any particular process let alone **BPSG** films. While we would not presume to suggest to appellants how to proceed under §1.196(b) in response to this new ground of rejection, under these circumstances it appears that appellants' invention would lend itself to being claimed using the so-called Jepson claim format in which the prior art process which appellants seek to improve by using helium is specifically set forth in detail in the preamble of the claim and wherein the improvement comprises using helium in place of nitrogen in whole or in part.

**SUMMARY**

Appeal No. 2000-0037  
Application 08/627,631

The rejection of the claims under 35 U.S.C. § 103, is **reversed**. We have made a new ground of rejection under 37 C.F.R. § 1.196(b).

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 1.196(b) (amended effective Dec. 1, 1997, by final rule notice, 62 Fed. Reg. 53,131, 53,197 (Oct. 10, 1997), 1203 Off. Gaz. Pat. & Trademark Office 63, 122 (Oct. 21, 1997)). 37 C.F.R. § 1.196(b) provides that, "A new ground of rejection shall not be considered final for purposes of judicial review."

37 C.F.R. § 1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of proceedings (§ 1.197(c)) as to the rejected claims:

(1) Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner. . . .

(2) Request that the application be reheard under § 1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

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

Appeal No. 2000-0037  
Application 08/627,631

**REVERSED**  
**37 C.F.R 1.196(b)**

ANDREW H. METZ )  
Administrative Patent Judge )  
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PETER F. KRATZ ) BOARD OF PATENT  
Administrative Patent Judge ) APPEALS AND  
) INTERFERENCES  
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Appeal No. 2000-0037  
Application 08/627,631

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