

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte STEPHAN ALAN COHEN,
VINCENT JAMES MCGAHAY and
RONALD ROBERT UTTECHT

Appeal No. 2000-1585
Application No. 08/883,427

ON BRIEF

Before LALL, DIXON, and BLANKENSHIP, Administrative Patent Judges
LALL, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claim 27, the only rejected claim in this application (examiner's answer at page 2, wherein the examiner has withdrawn the rejection of all the other pending claims).

According to appellants (brief at pages 2 and 3), the present invention relates to covering an interconnection wiring level or insulating adjacent devices in a semiconductor substrate. The use of thin film ceramic silica coatings as protective and dielectric layers for electronic devices is known in the art. Currently, SiO_2 (silicone dioxide) is used as the back-end dielectric in semiconductor devices. However, as chip function integration increases, back end wiring densities also increase. Because of this, there exists a greater need for intra-level insulators having lower dielectric constants than the presently used SiO_2 . This is crucial in order to reduce delays due to cross-talk and stray capacitance. The SiO_2 used prior to the present invention has a dielectric constant of 4, which may limit its use because of the potential cross-talk and RC delays. Moreover, because of reduced spacings between lines, the need for the insulation to conformally fill small spaces is increasingly important. Since device density is also increasing with increasing complexity, the need to electrically insulate devices from each other has become important as well. With smaller inter-device dimensions, providing trenches conformally filled

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with dielectrics between devices will become increasingly difficult. Specifically, the present invention relates to a process for covering an interconnection wiring level in a surface thereof on semiconductor substrate which comprises:

coating a first flowable oxide layer onto the interconnection wiring level;

curing the flowable oxide layer, and annealing said layer wherein said annealing is carried out in the presence of hydrogen and aluminum to cause gas to diffuse into the flowable oxide layer and reduce its dielectric constant to a value below 3.2.

The present invention is also concerned with a process for insulating adjacent devices in a semiconductor substrate. The process comprises providing a semiconductor device comprising a semiconductor substrate, at least two FET or bipolar transistor devices and a trench in the substrate located between the devices. The process further includes flowing a flowable oxide into the trench followed by curing and annealing. The annealing is carried out in the presence of hydrogen.

The following claim further illustrates the present invention.

27. A process for insulating adjacent devices in a semiconductor substrate which comprises:

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As a general proposition, in an appeal involving a rejection under 35 U.S.C. § 103, an Examiner is under a burden to make out a prima facie case of obviousness. If that burden is met, the burden of going forward then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. See In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

The examiner has set forth a detailed explanation of the rejection of claim 27 at pages 3 and 4 of the examiner's answer in accordance with the above guidelines of a rejection under § 103, wherein the examiner states (id. at page 4) that

it would have been obvious . . . to utilize the Ballance '868 resins as a filler for the trench structure of Sobczak because Sobczak teaches that siloxane resins should be used and because the siloxane resin of Ballance '868 in combination with the hydrogen anneal provide moisture resistant, stable dielectrics with few defects.

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Appellants first point out (brief at page 10) that

[c]laim 27 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 4,567,834 to Sobczak in view of either of U.S. Patent 5,441,765 to Ballance et al or U.S. Patent 5,320,868 to Ballance. (sic, Ballance et al.)

We note that the examiner did reject claim 27 based on Sobczak and Ballance '765 or Ballance '868 (final rejection at pages 6 and 7), as appellants argue in the brief. However, the examiner dropped the rejection based on Sobczak in view of Ballance '765 (answer at pages 2 and 3), therefore, the only rejection for our consideration on this appeal is the rejection of claim 27 based on Sobczak in view of Ballance '868 (herein called simply Ballance, consistent with the examiner's answer and appellants' brief).

Quoting a passage (brief at page 11) from the prosecution history of U.S. Patent 5,441,765 to Ballance et al., appellants argue (id.) that "[a]s stated above, the present invention recites annealing in the presence of hydrogen which is not suggested by Ballance. Furthermore, Ballance fails to suggest coatings having a dielectric constant of less than 3.2, as achievable according to the present invention." The examiner responds (answer at pages 4 and 5) that

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appellant's claim 27 does not require that a ceramic coating be annealed or a specific dielectric constant.

Claim 27 instead requires that curing and annealing steps be performed on a "flowable oxide". No order for these steps is required, so the curing and annealing may occur simultaneously. Furthermore, the specification discloses that the annealing may occur either along with the cure, or subsequent thereto (see page 9, lines 15-20).

Ballance '868 in combination with Sobczak meet (sic) all the requirements of claim 27. Ballance '868 teaches heating a hydrogen silsesquioxane flowable oxide layer in a hydrogen atmosphere to convert, or cure, the film into a ceramic. As the cure and anneal steps of claim 27 may occur simultaneously, claim 27 reads on the single heat step of Ballance.

Appellants have filed no rebuttal to the examiner's above-quoted response. We agree with the examiner's position that hydrogen gas is present in the environment where the flowable oxide is being heated, and the claim does not distinguish between the heating of a resin in hydrogen and the treating of a ceramic in hydrogen as argued by appellants.

Furthermore, appellants' argument regarding the alleged specific value of the dielectric constant of less than 3.2 for the flowable oxide after the heating process is meritless since this limitation is not recited in the claim.

Therefore, we sustain the obviousness rejection of claim 27 over Sobczak in view of Ballance. Accordingly, the decision of the examiner under 35 U.S.C. § 103 is affirmed.

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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

PARSHOTAM S. LALL)	
Administrative Patent Judge)	
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JOSEPH L. DIXON)	BOARD OF PATENT
Administrative Patent Judge)	APPEALS AND
)	INTERFERENCES
)	
)	
HOWARD B. BLANKENSHIP)	
Administrative Patent Judge)	

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