Paper No. 18

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte NORBERT ELBEL, ZVONIMIR GABRIC
and BERNHARD NEUREITHER

Appeal No. 2001-1559
Application No. 09/237,174[1]

HEARD: OCTOBER 8, 2002

Before HAIRSTON, JERRY SMITH and SAADAT, Administrative Patent Judges.

SAADAT, Administrative Patent Judge.

## DECISION ON APPEAL

This is a decision on appeal from the Examiner's final rejection of claims 1, 3, 5-12 and 15, which are all of the claims pending in the present application. Claims 2, 4, 13 and 14 have been canceled.

We reverse.

[1] Application for patent filed January 25, 1999, which is a continuation of the International Application No. PCT/DE97/01542, filed July 22, 1997, which claims the foreign filing priority benefit under 35 U.S.C. § 119 of German Application No. 196 29 766.4, filed July 23, 1996.

BACKGROUND

Appellants' invention is directed to a process for making a laterally insulated buried layer in a semiconductor substrate using deep trench isolation technology. A trench having at least one shallow region and at least one deep region is formed in the substrate through a reference layer, the substrate and the buried layer (specification, page 4). The trench is then filled with silicon oxide in an ozone-activated CVD process (specification, page 5). Thus, by selecting the material of the reference layer and the ratio of a width of the deep region to a step height of the shallow region, the two regions of the trench can be filled while the deposited insulation material maintains a planar top surface (specification, page 8).

Representative independent claim 1 is reproduced below:

> 1. A process for fabricating a buried, laterally insulated zone of increased conductivity in a semiconductor substrate, having the following steps:
>
> providing a silicon substrate with a buried zone of increased conductivity;
>
> forming a reference layer on the substrate;
>
> patterning the reference layer;
>
> forming a trench with at least one shallow region and at least one deep region in the substrate; and

filling the trench with silicon oxide insulation material and depositing the insulation material on the structure thus produced in an ozone-activated CVD process;

selecting a material of the reference layer such that a growth rate of the insulation material on the reference layer is at least by a factor of two less than a growth rate of the insulation material on a surface of the trench to be covered, a ratio of a width of the deep region to a step height of the shallow region being approximately equal to $2*\alpha/(\alpha-1)$, where $\alpha$ corresponds to a ratio of the growth rate of the insulation material on the surface of the trench to be covered to the growth rate of the insulation material on the reference layer.

The Examiner relies on the following references in rejecting the claims:

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| Kameyama | 4,472,240 | Sep. 18, 1984 |
| Sasaki et al. (Sasaki) | 4,551,911 | Nov. 12, 1985 |
| Bertagnolli et al. (Bertagnolli)[2] | DE 42 11 050 | Jul. 10, 1993 |
| Bohr | 5,536,675 | Jul. 16, 1996 |

Appellants' Admitted Prior Art, page 3.

Claims 1, 3, 5-12 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sasaki in view of the admitted prior art, Kameyama or Bohr and Bertagnolli.[3]

Rather than reiterate the viewpoints of the Examiner and Appellants regarding the above-noted rejection, we make reference to the answer (Paper No. 14, mailed January 26, 2001) for the

[2] The English translation of the German document is provided by the Translation Branch of USPTO, a copy of which accompanies this decision.

[3] Although the Examiner includes claims 2, 4, 13 and 14 in the rejection, these claims have been canceled in an amendment filed October 10, 2000 as paper No. 10.

Examiner's reasoning and the appeal brief (Paper No. 13, filed October 11, 2000) for Appellants' arguments thereagainst.

OPINION

At the outset, we note that Appellants state that the claims stand or fall with claim 1 (brief, page 9). Thus, we will consider the claims as one group and treat claim 1 as the representative claim of the group.

The Examiner relies on the teachings of Sasaki related to forming a trench with deep and shallow regions and concludes that the claimed ratio of the insulation material growth rate and the relationship of the trench width to its depth would have been obvious through routine experimentation (answer, page 4). The Examiner further relies on Bohr and Kameyama for the deep and shallow trench portions (answer, page 4) and on the admitted prior art for using trench technology for isolating sections of buried layer (answer, page 5). Finally, the Examiner adds teachings related to deep trench isolation from Bertagnolli (id.).

Appellants argue that the claimed method step of filling the trench with silicon oxide insulation material in an ozone-activated CVD process and achieving the claimed selective growth are neither taught nor suggested by the cited prior art (oral

hearing and brief, pages 10 & 11). Additionally, Appellants assert that a person skilled in the art would not have arrived at the claimed growth rate and the ratio of the width of the deep region to the height of the shallow region through calculations or routine experimentation (brief, page 11).

In response to Appellants' arguments, the Examiner asserts that Sasaki teaches filling the isolation trench with ozone-activated CVD (answer, page 6). However, the Examiner does not point to any particular part of the reference for such teachings. With respect to the growth rate of the isolation material and the trench width to step height ratio, the Examiner argues that the claim does not recite the ratio and merely describes the material (id.). The Examiner further asserts that by selecting the CVD process for a TEOS-based chemistry, Bohr teaches the ozone-activated CVD process (answer, page 7).

In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). The conclusion that the claimed subject matter is obvious must be supported by evidence, as shown by some objective teaching in the prior art or by knowledge generally available to one of ordinary skill in the art that

would have led that individual to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

Furthermore, the Examiner must produce a factual basis supported by teaching in a prior art reference or shown to be common knowledge of unquestionable demonstration, consistent with the holding in Graham v. John Deere Co., 383 U.S. 1 (1966). Our reviewing court requires this evidence in order to establish a prima facie case. In re Piasecki, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984); In re Cofer, 354 F.2d 664, 668, 148 USPQ 268, 271-72 (CCPA 1966).

A review of Sasaki confirms that the reference relates to a method of forming isolation regions having a deep narrow trench within a shallow wider trench. Sasaki further discloses (as depicted in fig. 4E) that trenches 125 and 106 are filled with CVD-$SiO_2$ isolation material 113a (col. 6 lines 41-52). However, we find no reference made by Sasaki to the use of ozone-activated CVD process for depositing the isolation oxide or any specific ratio of the width of the deep trench to the height of the shallow trench in relation to the growth rate of the deposited oxide.

Similarly, Bohr discloses a process for forming a deep, narrow trench within a shallow wide trench wherein both parts are filled with isolation material. More specifically, as depicted in figures 3d and 3e, Bohr fills both shallow trench 241 and deep trench 242 simultaneously using a CVD process with a TEOS-based chemistry (col. 7, lines 19-40). Kameyama and Bertagnolli also disclose deep trench isolation wherein CVD oxide is used for filling the trenches. Although Bohr mentions TEOS-based chemistry which may use an oxygen ($O_2$) activated process and Kameyama and Bertagnolli refer to CVD oxide deposition, we find nothing in these references that would have taught or suggested an ozone-activated CVD process for filling trenches having the claimed height to width ratio.

We also note that the Examiner does not point to any particular part of the prior art that may relate to the claimed ozone-activated CVD process or the width to height ratio in relation to the growth rate of the isolation material, nor can we find any relevant teachings in the references. In that regard, Sasaki, Bohr, Kameyama and Bertagnolli only refer to using CVD oxide to fill isolation trenches while nothing in the admitted prior art points to the use of ozone-activated CVD process for filling the trenches. Thus, even assuming, arguendo, that proper

motivation exists for combining Sasaki with Kameyama or Bohr and Bertagnolli, there is no indication that the resultant combination would arrive at the specific features recited in the rejected claims.

In view of our analysis above, we find that the Examiner has failed to set forth a prima facie case of obviousness with respect to claim 1 because the necessary teachings and suggestions to arrive at the claimed ozone-activated CVD process and the ratio of the deep trench width to the shallow trench height are not shown. Accordingly, we do not sustain the 35 U.S.C. § 103 rejection of independent claim 1, nor of claims 3, 5-12 and 15 dependent thereon.

CONCLUSION

In view of the foregoing, the decision of the Examiner rejecting claims 1, 3, 5-12 and 15 under 35 U.S.C. § 103 is reversed.

REVERSED

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| KENNETH W. HAIRSTON<br>Administrative Patent Judge | ) | |
| JERRY SMITH<br>Administrative Patent Judge | ) | BOARD OF PATENT APPEALS AND INTERFERENCES |
| MAHSHID D. SAADAT<br>Administrative Patent Judge | ) | |

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Lerner and Greenberg
Post Office Box 2480
Hollywood, FL 33022-2480

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