

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ZHONGZE WANG
and
INNA V. PATRICK

Appeal 2008-6334
Application 10/896,711
Technology Center 2800

Decided: January 15, 2009

Before KENNETH W. HAIRSTON, JOHN A. JEFFERY, and
THOMAS S. HAHN, *Administrative Patent Judges*.

HAHN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejections of claims 1-39 and 41-55. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a semiconductor device that is intended to have a reduced junction capacitance. The invented semiconductor device includes a gate formed on a substrate with an oxide layer deposited on sidewalls and the top of the gate. Spacers are deposited on the oxide layer about the gate sidewalls. The gate is used as a mask when a first dopant is implanted into the substrate to form a heavily doped source/drain region. The gate, again, is used as a mask when a second dopant is implanted deeper into the substrate to form a lower dosage, i.e., lightly, doped source/drain region below the first heavily doped source/drain region.¹ Claim 1 is illustrative:

1. A semiconductor device having reduced junction capacitance, comprising:

a substrate;

a polycide gate provided on said substrate, said polycide gate having nitride spacers formed on sidewalls thereof with an oxide layer therebetween, said oxide layer also being provided on a top surface of said polycide gate;

a first dopant implanted into said substrate, said first dopant having a first dosage sufficient to form a heavily doped source/drain region in said substrate adjacent said nitride spacers;

a second dopant comprising the same conductivity type as said first dopant but at a lower dosage than said first dosage and implanted deeper into said substrate to form a lightly doped source/drain region in said substrate below said heavily doped source/drain region.

¹ See generally Spec. ¶¶ 0023-0027; Figs. 3-6.

The Examiner relies upon the following as evidence in support of rejections:

Huang	US 5,350,698	Sep. 27, 1994
Ishimaru	US 5,998,849	Dec. 07, 1999
Wang	US 6,117,737	Sep. 12, 2000
Akamatsu	US 6,180,472 B1	Jan. 30, 2001
Lin	US 6,218,226 B1	Apr. 17, 2001
Chen	US 6,297,528 B1	Oct. 02, 2001

1. Claims 1-3, 5-14, 16-23, and 25 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang and Ishimaru.
2. Claims 4 and 15 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, and Lin.
3. Claim 24 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, and Wang.
4. Claims 26, 27, 29-32, and 34-39 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, Wang, and Akamatsu.
5. Claims 28 and 33 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, Wang, Akamatsu, and Lin.
6. Claims 41, 42, 44-47, and 49-53 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, and Akamatsu.
7. Claims 43 and 48 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, Akamatsu, and Lin.

8. Claim 54 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, Akamatsu, and Wang.

9. Claim 55 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Huang, Ishimaru, Akamatsu, and Chen.

Rather than repeat the arguments of Appellants or of the Examiner, we refer to the Briefs and the Answer² for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments that Appellants could have made but did not make in the Brief have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Appellants' Arguments

Appellants assert that the Examiner erred in the obviousness rejections because the combined references fail to teach or suggest the claim 1 recited limitation for “an oxide layer provided on said top surface and said sidewalls of said polycide gate electrode” (App. Br. 5). What Appellants argue is that Huang fails to teach or suggest the recited oxide layer, and that the thin film disclosed by Ishimaru does not cure the Huang deficiency (App. Br. 5). Premised on this argument, Appellants conclude that “one skilled in the art reading Huang and Ishimaru in their entirety would not make such a combination as there is no motivation to combine, the references teach away, and there is no reasonable expectation of success” (*Id.*).

² Throughout this opinion, we refer to (1) the Appeal Brief filed July 10, 2007, (2) the Answer mailed Dec. 03, 2007, and (3) the Reply Brief filed Feb. 01, 2008.

The Examiner responds with the explanation that “including the oxide film 4 disclosed in Ishimaru would clearly provide extra protection/insulation to the top of the gate structure of Huang from overetching [sic] and/or exterior effects that may damage the gate electrode” (Ans. 15). Not dissuaded, Appellants continue in their arguments “that there is no motivation to combine Ishimaru and Huang as they are addressing different problems, their teachings are unrelated, they teach away from each other, and that there is no reasonable expectation of success” (Reply Br. 4-5).

ISSUE

Have Appellants shown that the Examiner erred in rejecting claim 1 under § 103 by finding the claimed invention through the combination of references? The issue turns on whether the Examiner has provided articulated reasoning with some rational underpinning to support modification of Huang with the oxide film of Ishimaru.

FINDINGS OF FACT

The record supports the following Findings of Fact (FF) by a preponderance of the evidence:

1. Huang teaches a method for fabricating an integrated circuit device intended to minimize junction capacitance by using a self-aligning gate mask during source/drain implantation (Huang, col. 1, ll. 7-14, 60-65, and col. 4, ll. 7-12).

2. Huang discloses implantation of dopants into a semiconductor substrate using a polycide layer gate mask to form dual source/drain layers with a heavily doped source/drain layer overlaying a lightly doped but more energetically implanted source/drain layer (Huang, col. 1, l. 66 – col. 2, l. 16; col. 3, ll. 27-30 and 42-61; and col. 4, ll. 7-12; Figs. 3-5).
3. Ishimaru teaches fabrication of a semiconductor device intended to reduce leakage current flowing through a junction between source and drain and a substrate (Ishimaru, col.1, ll. 8-12).
4. The Ishimaru semiconductor device is taught as being made by implanting ions into source and drain regions, and using a mask with an oxide layer to provide protection during etching and that also has silicon nitride sidewalls (spacers) (Ishimaru, col. 3, ll. 1-7, 18-20, col. 4, ll. 24-31, and col. 4, l. 66 - col. 5, l. 5; Fig. 6C).

PRINCIPLES OF LAW

An Examiner must establish a factual basis to support a legal conclusion of obviousness in rejecting claims under 35 U.S.C. § 103. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). The factual determinations that the Examiner must make are set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

To address obviousness questions involving combinations of known elements, the Supreme Court explains:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique

has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [v. *AG Pro, Inc.*, 425 U.S. 273 (1976)] and *Anderson's-Black Rock* [, *Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR Int'l v. Teleflex, Inc., 127 S. Ct. 1727, 1740 (2007).

If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that “there was an apparent reason to combine the known elements in the fashion claimed.” *Id.* at 1740-41. Such a showing requires

some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

Id. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)) (internal quotation marks omitted).

When the Examiner’s burden is met there is a shift in the burden to the Appellants to overcome the Examiner’s 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 (Fed. Cir. 1992).

ANALYSIS

Obviousness Rejection over Huang and Ishimaru

Representative Claim 1

The Examiner finds the limitations recited in representative independent claim 1 as being taught in Huang except for (1) “spacers being nitride,” and (2) “an oxide layer” on the sidewalls and top of a polycide gate (Ans. 4). We also find that Huang teaches a semiconductor device made by using a polycide layer gate mask in conjunction with implantation of dopants into a semiconductor substrate to form dual source/drain layers with a more heavily doped source/drain layer overlaying a lower less doped source/drain layer (FF 1 and 2). The Examiner further finds Ishimaru teaching the claim 1 limitations not taught in Huang, namely the Examiner finds Ishimaru discloses providing (1) “sidewalls (spacers) comprising silicon nitride” adjacent a gate, and (2) a “thin film comprising silicon dioxide” on top and against sidewalls of a gate (Ans. 4).

Appellants do not contest the Examiner’s findings concerning Huang teachings. Instead, Appellants’ substantive arguments are directed to the Examiner’s findings concerning the Ishimaru taught oxide layer formed on a polycide gate (App. Br. 5-10). In conjunction with directing their substantive arguments to Ishimaru teachings, Appellants assert that “one skilled in the art reading Huang and Ishimaru in their entirety would not make such a combination as there is no motivation to combine, the references teach away, and there is no reasonable expectation of success” (App. Br. 5).

A.

With respect to motivation for combining Huang and Ishimaru teachings, Appellants argue that the references address different problems (App. Br. 6). Huang, Appellants assert is directed to using “a self-aligning mask suitable for high energy (i.e., above 100 Kev) source/drain implantation,” and Ishimaru, Appellants assert is directed to addressing “punch-through or hot carriers formation in double drain MOS transistors” (*Id.*).

With respect to what Huang and Ishimaru teach, we find both references disclosing methods of fabrication for semiconductor devices that use gates as masks for dopant implantation to form source/drain regions in substrates (FF 1, 2 and 4).

Not persuaded by Appellants’ different addressed problems argument, the Examiner explains that “Huang discloses all the limitations of the [A]ppellant[s]’ claims except for an oxide film which Ishimaru clearly discloses ... [and that] does not affect the electrical operation of the Huang’s semiconductor device, but only ... physically protect[s] the top surface of a gate electrode”³(Ans. 16). The Examiner then concludes that “it would have been obvious to one of ordinary skill in the art to include the oxide film of Ishimaru into Huang in order to protect the top of a gate electrode” (*Id.*). Appellants disagree, and argue “the [E]xaminer has come to a conclusion that any

³ The Examiner earlier notes that Huang also does not disclose claim 1 recited nitride spacers, but that Ishimaru discloses such structures and that it would have been obvious to a skilled artisan to use the Ishimaru disclosed spacers to “protect the lateral edges of a gate electrode” (Ans. 4). Appellants are silent concerning these Examiner findings and conclusions, and, therefore, have waived argument.

oxide layer independently known in the prior art can be provided as protection to a gate electrode, and thus one skilled in the art would want to apply Ishimaru oxide layer on top of Huang's gate for extra protection" (Reply Br. 3) (emphasis deleted). Appellants further argue:

[I]t would be counter-intuitive to one of ordinary skill in the art when trying to find ways to provide a self-aligning polysilicon gate that is suitable as a mask for high energy implantation (>100 KeV) of the source/drain regions as taught in Huang to, mysteriously and somewhat out of the air, decide to add an additional element (i.e., the oxide layer of Ishimaru) which would clearly add additional processing steps, volume and density, and expense to the device in order to solve a non-existent problem of needing extra protection on the gate structure.

(Reply Br. 3) Appellants have not submitted evidence to support these attorney arguments. Without supporting evidence, these attorney arguments do not rebut a prima facie case of obviousness.⁴

We note that Appellants are silent and do not controvert the Examiner's assertion that the Ishimaru oxide film "does not affect the electrical operation of the Huang's semiconductor device, but only ... physically protect[s] the top surface of a gate electrode" (Ans. 16). Instead, Appellants argue that "add[ed] extra protection to a gate electrode as such is

⁴ An attorney argument is not evidence unless it is an admission, because "[a]n assertion of what seems to follow from common experience is just attorney argument and not the kind of factual evidence that is required to rebut a prima facie case of obviousness" (citations omitted) *In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997).

not even a problem being addressed by Appellant[s], Huang, or Ishimaru” (Reply Br. 4).

First, we concur with the Examiner that Ishimaru discloses using a protective oxide layer for a gate that is to be used as a mask during dopant implantation (FF 4). Second, Appellants argue without explanation that using a protective oxide layer as “add[ed] extra protection to a gate ... is not ... a problem” they address. Appellants do not dispute by argument or submitted evidence as to any other use or purpose for the claim 1 recited oxide layer on “said polycide gate.” In contrast, the Examiner provides reasoning and some rational underpinning for the prima facie obviousness rejection by indicating that Ishimaru teaches using an oxide layer to improve, i.e., protect, the Ishimaru gate mask, and that a skilled artisan would recognize that using an oxide layer would protect the Huang gate mask device⁵ (Ans. 4). Accordingly, we are not persuaded by Appellants’ arguments that the references address different problems and provide unrelated teachings so that there is no motivation for combining Huang and Ishimaru for a prima facie obviousness rejection.

⁵ “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [*v. AG Pro, Inc.*, 425 U.S. 273 (1976)] and *Anderson's-Black Rock* [*, Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.”

KSR, 127 S. Ct. at 1740.

B.

Appellants further argue that Huang and Ishimaru teach away from each other. Again, asserting attorney argument, without supporting evidence, Appellants argue that the references teach away in that (1) “Ishimaru *would appear*” to disclose use of implantation energies lower than Huang, (2) “Huang criticizes single layer polysilicon gates such as those taught by Ishimaru,” and (3) Huang “*seemingly* does form an oxide layer on top of layer 24, but then deliberately etches it away. Col. 3, lines 46-51, and comparing FIGS. 3 and 4” (App. Br. 8) (emphasis added). The Examiner is not persuaded by these arguments, and notes “Huang and Ishimaru are NOT significantly different structural formations, but are both the same type of semiconductor device, a field effect transistor” (Ans. 18).

As a first matter, Appellants’ asserted teachings away are attorney arguments made without supporting evidence, and, therefore, do not rebut the Examiner’s prima facie case of obviousness.⁶ Further, representative claim 1 recited limitations are silent as to implantation energy levels that might distinguish over a reference. Additionally, representative claim 1 covers a “polycide gate having nitride spacers formed on sidewalls thereof with an oxide layer therebetween [and] ... on a top surface of said polycide gate” without further structure limitations distinguishing what gate structures are covered. Accordingly, we concur with the Examiner in noting that “[t]he implantation energies and composition of the gate electrode does not change the fact that Huang already discloses the [A]ppellant[s]’ claimed structure

⁶ See n.4, *supra*, of this opinion.

and that it would have been obvious to one of ordinary skill in the art to include Ishimaru's oxide film to protect Huang's gate electrode" (Ans. 17).

C.

Finally, Appellants argue that no reasonable expectation of success is provided with the combined references, because "the Examiner's extra protection purpose of providing the oxide layer of Ishimaru to the gate structure of Huang ...lack[s] ... suggestion [for] combin[ation] and teach[es] away, [and] does not even rise to the level of a general approach that seemed to be a promising field of experimentation" (App. Br. 9-10) (quotations and citation omitted). The Examiner notes that Appellants have "not provided any reason why there would not be a reasonable expectation of success when the only modification being made is the addition of an oxide layer to the exterior of a gate electrode" (Ans. 20). Appellants are effectively silent in response to this statement by the Examiner, and only state their disagreement with a reference to pages from their Appeal Brief that set out the above reproduced argument and not reasons with evidence (Reply Br. 5). We are persuaded that the Examiner has provided reasoning and some rational underpinning for the asserted Huang and Ishimaru combination by explaining that "Ishimaru is only used to physically add a layer of oxide to the gate electrode of Huang which does not affect the electrical operation of the semiconductor device of Huang" (Ans. 20). Appellants have not argued or submitted evidence to rebut the Examiner's findings that (1) an oxide layer would not affect the electrical operation of the semiconductor device of

Huang, and (2) an oxide layer would provide protection for the Huang gate as taught by Ishimaru.

For the reasons indicated, we are not persuaded by Appellants' arguments. Furthermore, in combining the teachings of Huang with Ishimaru, we find the Examiner has provided reasoning with some rational underpinning to support the legal conclusion of obviousness (Ans. 4-6). Appellants have simply not persuasively rebutted the Examiner's position in this regard – a position that we find reasonable.

Appellants have not persuaded us of error in the Examiner's prima facie obviousness rejection of claim 1. Therefore, we will sustain the Examiner's rejection of that claim, and claims 2, 3, 5-14, 16-23, and 25 that fall with claim 1, as admitted by Appellants (App. Br. 3).

Obviousness Rejections of Claims 4, 15, 24, 26-39, and 41-55

We find that Appellants, by merely alluding that additional references fail to cure the previously-noted deficiencies of Huang and Ishimaru (App. Br. 10-14 and Reply Br. 5), have not persuasively rebutted the Examiner's prima facie case of obviousness for (1) claims 4 and 15 over Huang, Ishimaru, and Lin (Ans. 7); (2) claim 24 over Huang, Ishimaru, and Wang (Ans. 7-8); (3) claims 26, 27, 29-32, and 34-39 over Huang, Ishimaru, Wang, and Akamatsu (Ans. 8-10); (4) claims 28 and 33 over Huang, Ishimaru, Wang, Akamatsu, and Lin (Ans. 11); (5) claims 41, 42, 44-47, and 49-53 over Huang, Ishimaru, and Akamatsu (Ans. 11-13); (6) claims 43 and 48 over Huang, Ishimaru, Akamatsu, and Lin (Ans. 13); (7) claim 54 over Huang, Ishimaru, Akamatsu, and Wang (Ans. 14); and (8) claim 55 over Huang, Ishimaru, Akamatsu, and Chen (Ans. 14).

Once the Examiner has satisfied the burden of presenting a prima facie case of obviousness, the burden then shifted to Appellants to present evidence and/or arguments that persuasively rebut the Examiner's prima facie case. *See Oetiker*, 977 F.2d at 1445. Since Appellants did not particularly point out errors in the Examiner's reasoning to persuasively rebut the Examiner's prima facie case of obviousness, the rejections are therefore sustained.

CONCLUSIONS OF LAW

Appellants have not shown that the Examiner erred in combining Huang and Ishimaru under § 103 to arrive at the invention as indicated in the rejection of claim 1. Also, Appellants have not shown error in the Examiner's obviousness rejections of claims 2-39 and 41-55. In particular, Appellants have not shown the Examiner erred in the provided reasoning and rational underpinning to support modification of Huang with the oxide film of Ishimaru.

DECISION

We have sustained the Examiner's rejections with respect to all claims on appeal. Therefore, the Examiner's decision rejecting claims 1-39 and 41-55 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

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AFFIRMED

gvw

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