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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JAE GON LEE, LEE WEE TEO, and
SEONG-DONG KIM

Appeal 2010-005484
Application 11/618,453
Technology Center 2800

Before ERIC B. CHEN, STANLEY M. WEINBERG, and
JOHN A. EVANS, *Administrative Patent Judges*.

WEINBERG, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1-20. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

Claims 1-5, 10, 11, and 15-20 stand rejected under 35 U.S.C. § 103(a) as obvious over Cheng (US 2007/0020866 A1, Jan. 25, 2007) in view of Sudo (US 2007/0262392 A1, Nov. 15, 2007).[1]

Claims 6-9 and 12-14 stand rejected under 35 U.S.C. § 103(a) as obvious over Cheng in view of Kohyama (US 2006/0231826 A1, Oct. 19, 2006) and Sudo.[2]

STATEMENT OF THE CASE

Appellants' invention relates to an integrated circuit system employing strained technology having NMOS and PMOS devices. An SiO_2 shallow trench isolation (STI) 138 in Si substrate 118 separates NMOS device 102 and PMOS device 104. The difference in thermal expansion between the SiO_2 and the Si produces strain in PMOS channel 126 and NMOS channel 110. Although strain in PMOS channel 126 improves performance, strain in the NMOS channel 110 degrades performance. A strain suppressing feature 1800 that reduces strain to NMOS channel 110 is generally rectangular, parallel to the length of NMOS gate 106, in the STI

[1] Throughout this opinion, we refer to (1) the Appeal Brief filed May 28, 2009; (2) the Examiner's Answer mailed October 2, 2010; and (3) the Reply Brief filed December 2, 2009.

[2] Claim 10 depends from claim 6. The Examiner inadvertently grouped claim 10 with claim 1, instead of with claim 6. The rejection of claim 10 relies upon Sudo for the specific limitations recited in claim 10 as the Answer explains in detail. Ans. 6-7. The incorrect grouping is therefore harmless error.

138, and perpendicular to the direction of the strain. STI 138 is formed around strain suppressing feature 1800 and is therefore a region of substrate 118 that has not been formed into STI 138. The distance between strain suppression feature 1800 and NMOS device 102 affects the strain on NMOS device 102. Because strain increases as the distance increases, strain can be optimized by adjusting the position of strain suppressing feature 1800 relative to NMOS device 102. *See generally* Spec. 1:3-4; 5:1-4, 22-25; 13:9-14:2. Figs. 1, 18.

Independent claim 1 is illustrative with key disputed limitations emphasized:

> 1. A method of manufacture for an integrated circuit system comprising:
> providing a substrate with a PMOS device and an NMOS device;
> forming an NMOS shallow recess within the substrate;
> forming a PMOS recess within the substrate;
> forming a strain inducing layer over the PMOS recess;
> *forming a strain suppressing feature adjacent the NMOS device*; and
> forming a first dielectric layer over the NMOS device and a second dielectric layer over the PMOS device.

The Examiner finds that Cheng discloses every recited feature of representative claim 1 except for forming a strain suppressing feature adjacent the NMOS device; but finds that Sudo's element 101 isolated by element 130 adjacent to its NFET discloses a structure that is identical to Appellants' strain suppressing feature. Ans. 4:13-18.

Appellants contend that Sudo's elements 101 and 130 do not disclose a strain suppressing feature adjacent an NMOS device, but instead disclose an STI layer 130 that prevents stray current from flowing into and out from adjacent NFET and PFET devices. App. Br. 11:20-23.

ISSUE

Under § 103, has the Examiner erred by finding that Sudo teaches a strain suppressing feature adjacent an NMOS device?

ANALYSIS

THE OBVIOUSNESS REJECTION OVER CHENG IN VIEW OF SUDO

Claims 1, 3, 4, 11, and 15-20

We begin by construing the key disputed limitation of claim 1 which recites, in pertinent part, "a strain suppressing feature adjacent the NMOS device."

Appellants' Specification discloses a "STI [shallow trench isolation] 138 is made of silicon dioxide ("SiO_2") and the substrate 118 is made of Si." Spec. 13:12-13; Fig. 18. A "strain suppressing feature 1800 [is] generally rectangular [and] parallel to the length of the NMOS gate 106." Spec. 13:18-20. The STI 138 is "formed around the strain suppressing feature 1800. Thus . . . the strain suppressing feature 1800 is a region of the substrate 118 that has not been formed into the STI 138, but instead remains unaltered by the STI-forming process." Spec. 13:27-30. Thus, under the broadest reasonable interpretation consistent with the Specification, the "strain suppressing feature" 1800 is defined as a rectangular feature that is parallel to the length of the NMOS gate 106 comprising a region of the silicon substrate 118 that has not been formed into the STI 138 so that the STI 138 is formed around the strain suppressing feature 1800.

The Examiner finds that Sudo's Figs. 1 and 2 show rectangular silicon element 101 isolated by (i.e., surrounded by) STI 130 and adjacent to Sudo's NFET. Ans. 4:15-18; 14:17-15:1. The Examiner therefore finds that Sudo's

Figs. 1 and 2 depict a structure that is identical to Appellants' strain suppressing feature 1800. Ans. 4:15-18; 14:20-15:1.

Appellants argue that Sudo's elements 101 and/or 130 do not disclose an "intent of suppressing strain" because Sudo's elements 101 and 130 are formed "with the intent to prevent stray current from flowing between adjacent NFET and PFET devices." App. Br. 11:31-35. Purported intent or lack of intent, however, is not indicative of structural differences.

Appellants also argue that (1) a skilled person would know that forming STI layer 130 for purposes of electrical isolation is not the equivalent of forming a strain suppressing feature (App. Br. 13:21-23); and (2) "Sudo's silicon structure 101 may not be appropriately designed and/or located to suppress strain." Reply Br. 5:28-29. These latter arguments are not persuasive because Appellants present no evidence in support of them.

Appellants also present a number of arguments regarding the position of Sudo's element 101 within Sudo's device based upon what a skilled person purportedly would know regarding the relationship of the distance between a strain suppressing feature and its intended target. App. Br. 13:23-25; Reply Br. 3:11-14; Reply Br. 4:5-8; Reply Br. 5:18-29. These arguments are not persuasive because claim 1 does not recite the position of the strain suppressing feature.

Because Appellants have not persuasively countered the Examiner's comparison of Sudo's structure to Appellants' structure, we agree with the Examiner's finding that Sudo's structure is identical to Appellants' structure.

Based on the Examiner's finding of Sudo's identical structure, the Examiner concludes that Sudo's identical structure is capable of serving as a strain suppressing feature and that it is reasonable to predict that Sudo's

structure is capable of serving as a strain suppressing feature. Ans. 15:1-4. Appellants argue that Sudo does not inherently teach a strain suppressing feature (App. Br. 12:1-21) and does not enable the claimed limitation because Sudo does not teach the critical location of the strain suppressing feature (Reply Br. 4:8-16; 5:18-30). As we have indicated, claim 1 does not recite a location of the strain suppressing feature.

In addition, as we have found, Sudo's structure is identical to Appellants' structure. The inherent properties of prior art elements need not be disclosed in the prior art. *See In re Woodruff*, 919 F.2d 1575, 1577-78 (Fed. Cir. 1990) (obviousness rejection affirmed where using claimed elements in the manner suggested by the prior art necessarily resulted in claim-recited effect); *see also In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991) ("Mere recognition of latent properties in the prior art does not render nonobvious an otherwise known invention.").

Once a *prima facie* case of obviousness has been established, the burden shifts to the Appellants to prove that the prior art product does not necessarily or inherently possess the characteristics of the claimed product. *See In re Best*, 562 F.2d 1252, 1255 (CCPA 1977):

> Where, as here, the claimed and prior art products are identical or substantially identical, or are produced by identical or substantially identical processes, the PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his claimed product. [citation omitted] Whether the rejection is based on 'inherency' under 35 U.S.C. § 102, on 'prima facie obviousness' under 35 U.S.C. § 103, jointly or alternatively, the burden of proof is the same, and its fairness is evidenced by the PTO's inability to manufacture products or to obtain and compare prior art products.

Appellants have not presented any evidence in support of their burden of proof.

For the reasons we have outlined above, we conclude that Appellants have not proven that Sudo's device is different from their claimed device.[3]

We are therefore not persuaded that the Examiner erred in rejecting (1) representative claim 1; (2) claim 11 for similar reasons; and (3) claims 3, 4, and 15-20 not separately argued with particularity.

Accordingly, we will sustain the Examiner's rejection of claims 1, 3, 4, 11, and 15-20.

Claim 2

The Examiner finds that the limitations of claim 2 are taught by Cheng's recessed surfaces 326 and 328 in Cheng's Fig. 19. Ans. 6. In response to Appellants' counter-arguments, the Examiner provides additional support for the Examiner's findings. Ans. 16-17, 20:8-21:5.

Appellants, however, do not explain why the Examiner's findings are incorrect. Instead, Appellants refer to their own device (Reply Br. 7:21-24) and contend that the Examiner's interpretation of Cheng would result in reducing device performance. Reply Br. 7:24-27.

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[3] Appellants also argue that the Examiner does not teach or suggest how Sudo's shallow trench oxide structure 130 and silicon regions 101 can be incorporated into Cheng. Reply Br. 6-7. This argument has been made for the first time in the Reply Brief. "[T]he reply brief [is not] an opportunity to make arguments that could have been made in the principal brief on appeal to rebut the Examiner's rejections, but were not." *Ex parte Borden*, 93 USPQ2d, 1473, 1474 (BPAI 2010) (informative). "[A]n issue not raised by an appellant in its opening brief . . . is waived." *Optivus Tech., Inc. v. Ion Beam Appl'ns. S.A.*, 469 F.3d 978, 989 (Fed. Cir. 2006) (citations and quotations marks omitted).

Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). In addition, Appellants have not provided any evidence supporting their reduced performance assertion.

We are therefore not persuaded that the Examiner erred in rejecting claim 2.

Accordingly, we will sustain the Examiner's rejection of claim 2.

Claims 5 and 18

In the January 6, 2009 Final Rejection of claims 5 and 18, the Examiner rejected these claims based upon column 6, lines 7-10 of Cheng, this cited portion of Cheng being in paragraph 0031. *See* Final Rej. pp. 4, 6. In the Answer, the Examiner finds that the entire paragraph 0031, not just column 6, lines 7-10, teach the recited limitations. Ans. 6, 18. For example, Cheng ¶ 0031, ll. 5-8 states:

> "a second portion 150_2 over the nMOS region [provides] a tensile stress to the channel of the nMOS device. In other embodiments, entire CESL 150 provides a tensile stress.

Appellants do not persuasively rebut the Examiner's findings because they do not explain why the *entire* paragraph 0031 of Cheng fails to support the Examiner's findings. Reply Br. 8:11-26. Instead, Appellants quote a different part of Cheng, ¶ 0033 (Reply Br. 8:16-18), and seek to incorporate part of their specification into the claims, which is not permissible. Reply Br. 8:19-26. *See In re van Geuns, supra.*

We are therefore not persuaded that the Examiner erred in rejecting claims 5 and 18.

Accordingly, we will sustain the Examiner's rejection of claims 5 and 18.

Claims 10 and 20

Even though Appellants recognize that the Examiner did not group claim 10 with claim 6 as the Examiner should have done (App. Br. 16:7-10; Reply Br. 10:3-6, 15-18) (*see* footnote 2, *supra*), Appellants nevertheless argue claims 10 and 20 together in the section of their Appeal Brief and Reply Brief that discusses the Cheng/Sudo rejection, rather than the Cheng/Sudo/Kohyama rejection. App. Br. 16-17; Reply Br. 9-10.

Representative claim 10, which depends from claim 6, recites "forming the strain suppressing features includes forming the strain suppressing feature within a shallow trench isolation." The Examiner finds that this limitation is found in Sudo. Ans. 6:22-7:2.

Appellants first contend that the Cheng/Sudo combination does not teach this limitation because Sudo does not teach a strain suppressing feature. App. Br. 16:22-26. However, as discussed above, Sudo does, in fact, teach a strain suppressing feature.

Appellants next contend that the Cheng/Sudo combination does not teach the limitations of claim 10 because Cheng/Sudo does not teach claim 6's limitation "forming a PMOS shallow recess and an NMOS shallow recess." App. Br. 16:27-29. But, Appellants do not explain why the Examiner's initial analysis incorrectly finds that the references teach this limitation in claim 6. *Compare* Ans. 10:6-7 *with* App. Br. 17:4-8. Secondly, even though the Examiner also refers not only to Cheng's Figs. 13a and 19, but also to Cheng's paragraphs 0022 and 0037 (Ans. 21:3),

Appellants discuss only Figs. 13a and 19. We find the Examiner's reliance on all of the cited parts of Cheng to be reasonable.

We are therefore not persuaded that the Examiner erred in rejecting claim 10 and claim 20 not separately argued with particularity.

Accordingly, we will sustain the Examiner's rejection of claims 10 and 20.

THE OBVIOUSNESS REJECTION OVER CHENG IN VIEW OF KOHYAMA AND SUDO

Claim 6

Appellants contend that the cited references do not teach claim 6's recitation of "forming a strain suppressing feature adjacent the NMOS device." App. Br. 18. Since the contested claim 6 limitation is identical to the contested claim 1 limitation, and since Appellants' arguments regarding claim 6 are substantially the same as their arguments regarding claim 1 (*compare* App. Br. 11:19-14:18 *with* App. Br. 18:29-21:21 and *compare* Reply Br. 5:11-23; 6:15-17 *with* Reply Br. 11:17-27), we agree with the Examiner's rejection of claim 6 for the same reasons we discussed above regarding the Examiner's rejection of claim 1.

In the context of discussing the rejection of claim 10 (which depends from claim 6), Appellants contend that the cited prior art does not teach claim 6's recitation: "forming a PMOS shallow recess and an NMOS shallow recess. App. Br. 16:27-29. However, in the course of discussing the Examiner's rejection of claim 6, Appellants do not explain why the Examiner's findings are incorrect regarding "forming a PMOS shallow recess and an NMOS shallow recess." *Compare* Ans. 10:6-7 *with* App. Br. 17:4-8. We find the Examiner's reliance of Cheng to be reasonable.

We are therefore not persuaded that the Examiner erred in rejecting claim 6.

Accordingly, we will sustain the Examiner's rejection of claim 6.

Claims 7-9 and 12-14

Method claim 7 recites the PMOS and NMOS shallow recesses are formed to a depth of "about 30 nanometers to about 60 nanometers." Apparatus claim 13 contains a similar limitation. The Examiner finds that Kohyama teaches a thickness range of 15-25 nm and concludes that it would have been obvious to form shallow thickness from 30 nm to about 60 nm through routine experimentation of the etch chemistry and parameters because it is well known in the semiconductor fabrication process to optimize the etch thickness of a parameter with a technology using design of experiment technique to meet certain product specific performance and reliability. Ans. 12:8-13. Moreover, the Examiner finds that there is no evidence indicating the ranges of the height of the claimed thickness is critical or that any unexpected results arise from them. Ans. 12:14-19.

Appellants do not dispute the Examiner's findings or conclusions above based upon those findings. App. Br. 21:25-22:20; Reply Br. 11-12. Instead, Appellants argue Kohyama separately. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *In re Merck & Co.*, Inc., 800 F.2d 1091, 1097 (Fed. Cir. 1986).

We are therefore not persuaded that the Examiner erred in rejecting (1) representative claim 7; (2) claim 13 for similar reasons; and (3) claims 8, 9, 12, and 14 not separately argued with particularity.

Accordingly, we will sustain the Examiner's rejection of claims 7-9 and 12-14.

CONCLUSION

Under § 103, the Examiner did not err in rejecting claims 1-20.

DECISION

The Examiner's decision rejecting claims 1-20 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). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2010).

AFFIRMED

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