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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MAKOTO SAITO,
STEVEN P. DENBAARS, JAMES S. SPECK,
and SHUJI NAKAMURA

Appeal 2016-000029
Application 12/474,134
Technology Center 1700

Before KAREN M. HASTINGS, GEORGE C. BEST, and
N. WHITNEY WILSON, *Administrative Patent Judges*.

BEST, *Administrative Patent Judge.*

DECISION ON APPEAL

The Examiner rejected claims 12 and 14–29 under 35 U.S.C. § 103(a) as obvious. Final Act. (December 2, 2014). Appellants[1] seek reversal of these rejections pursuant to 35 U.S.C. § 134(a). We have jurisdiction. 35 U.S.C. § 6(b). For the reasons set forth below, we AFFIRM.

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[1] The Regents of the University of California are identified as the real party in interest. Appeal Br. 1.

BACKGROUND

The ’134 Application describes a solvo-thermal method for simultaneously growing high quality and high growth rate bulk hexagonal würtzite single crystals. Spec. 5:29–31. According to the ’134 Application, crystal quality and growth improvements are dependent on proper selection of crystal growth planes on nonpolar or semipolar seed surfaces. *Id.* at 6:1–27.

Claim 12 is representative of the ’134 Application’s claims and is reproduced below:

> 12. A method of growing a III-nitride single bulk crystal with a hexagonal w[ü]rtzite structure, comprising:
>
> > performing solvo-thermal crystal growth on a III-nitride seed crystal having a growth surface comprising a nonpolar plane having an off-orientation angle that is larger than 0.5 degrees and is also 48 degrees or less or a semipolar plane to create the III-nitride single bulk crystal, wherein growth on the growth surface of the III-nitride seed crystal comprising the nonpolar plane having the off-orientation angle that is larger than 0.5 degrees and is also 48 degrees or less or the semipolar plane results in a smoother surface as compared to growth on a III-nitride seed crystal having a growth surface comprising a polar plane.

Appeal Br. 17 (Claims App.).

REJECTIONS

On appeal, the Examiner maintains the following rejections:

1. Claims 12, 14–18, and 20–29 are rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Callahan,[2] Dwilinski,[3] and Grudowski.[4] Final Act. 2.
2. Claim 19 is rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Callahan, Dwilinski, Grudowski, and Xu.[5] Final Act. 24.

DISCUSSION

Appellants argue for the reversal of the rejections to claims 14–29 on the basis of limitations present in claim 12. *See* Appeal Br. 7–15; Reply Br. 1–8. We, therefore, limit our analysis to the rejection of claim 12. Claims 14–29 will stand or fall with claim 12. 37 C.F.R. § 41.37(c)(1)(iv).

Rejection 1. We affirm this rejection based upon the findings of fact and reasoning set forth on pages 2–24 of the Final Action and pages 2–5 of the Examiner's Answer. We adopt these factual determinations and reasoning as our own. We add the following for emphasis.

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[2] Michael J. Callahan et al., *Growth of GaN crystals under ammonothermal conditions*, 798 MAT. RES. SOC. SYMP. PROC., Y2.10.1–Y2.10.6 (2004).

[3] WO 2006/057463 A1, published June 1, 2006. We shall follow the Examiner and Appellants by referring to the national stage entry US 7,905,957 B2, issued Mar. 15, 2011.

[4] P.A. Grudowski et al., *The effect of substrate misorientation on the photoluminescence properties of GaN grown on sapphire by metalorganic chemical vapor deposition*, Vol. 69 (24) APPL. PHYS. LETT. 3626–28 (December 9, 1996).

[5] US 2006/0029832 A1, published Feb. 9, 2006.

Appellants argue, *inter alia*, that the rejection should be reversed for any of three reasons. We are not persuaded by any of these arguments. We address these arguments in turn.

First, Appellants argue that Callahan, Dwilinski, and Grudowski cannot be combined because the "growth methods, starting materials and growth surfaces [of the applied prior art] are all so different." Reply Br. 4. In particular, Appellants argue that "one of skill in the art would not look to combine [Callahan's and Dwilinski's] ammonothermal growth on III-nitride seed crystals . . . with [Grudowski's] MOCVD growth on sapphire substrates . . . because the techniques and materials are so different." Appeal Br. 12; *see generally* Reply Br. 2–4 and 6.

We are not persuaded by this argument. Appellants do not point to any evidence that the ordinary skilled artisan would not have been capable of modifying the subsidiary Grudowski reference in the manner proposed by the Examiner. Without such evidence, this assertion is not persuasive. *See Estee Lauder Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 595 (Fed. Cir. 1997) ("[A]rguments of counsel cannot take the place of evidence lacking in the record.").

In an obviousness determination, a combination of references must be considered for what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. *See, e.g.*, *In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971).

Here, the Examiner found that ammonothermal growth is a cost-effective method for producing GaN bulk crystals. Ans. 4 (citing Callahan Y2.10.2, 1st full ¶); *see also* Dwilinski col. 1:26–35. The Examiner further found that Dwilinski teaches that ammonothermal growth of GaN yields quality parameters higher than that obtained by MOCVD. Ans. 4; *see also*

Dwilinski 1:26–35. In view of these descriptions, we neither discern nor have Appellants persuaded us that the Examiner erred in concluding that use of an ammonothermal method for producing higher quality GaN bulk crystals at lower costs would have been obvious to a person of ordinary skill in the art considering the combined descriptions of Callahan, Dwilinski, and Grudowski. Appellants, furthermore, do not provide any technical reason why the process or materials described in Grudowski could not be modified in the manner suggested by the Examiner.

Second, Appellants argue that the Examiner erred in combining Grudowski with Callahan and Dwilinski because Grudowski's photoluminescence intensity increase does not indicate surface smoothness. Appeal Br. 11; Reply Br. 4–5. Rather, Appellants assert that Grudowski's higher photoluminescence intensity indicates decreased incorporation of unwanted impurities and/or reduced density of nitrogen vacancies. Appeal Br. 11 (citing Grudowski p. 3627, 1st full ¶; p. 3628, 1st full ¶).

"It is well settled that a prior art reference is relevant for all that it teaches to those of ordinary skill in the art." *In re Fritch*, 972 F.2d 1260, 1264 (Fed. Cir. 1992). As the Examiner found, Grudowski teaches that photoluminescence "is utilized as a 'characterization tool to evaluate material properties, including the crystal quality, [and] interface quality. . . .'" Ans. 2–3 (citing Grudowski p.3626, 2nd full ¶). Appellants' arguments fail to persuasively demonstrate error in the Examiner's position that Grudowski's "'interface quality'" reasonably encompasses surface roughness because the crystal surface is an interface between a solid and the

atmosphere.[6] *See* Ans. 3. The Examiner, furthermore, does not rely on Grudowski alone for teaching crystal growth methods that provide improvements in crystal surface smoothness. The Examiner found that Dwilinski identifies a reduced surface roughness as a result of ammonothermal growth on nonpolar surfaces. Ans. 4. Appellants do not dispute this finding. *See* Reply Br. 7. We do not discern reversible error in these findings.

Thus, we are not persuaded by this argument.

Third, Appellants argue that the Examiner erred in combining Dwilinski with Callahan and Grudowski because Dwilinski does not identify a reduced surface roughness for crystals grown on non-polar planes having an off-orientation angle or semipolar planes. Reply Br. 6–7; *see also* Appeal Br. 10. Appellants further argue that Dwilinski does not teach that crystals grown on non-polar planes having an off-orientation angle or semipolar planes "result[] in a smoother surface as compared to growth on a III-nitride seed crystal having a growth surface comprising a polar c-plane." Appeal Br. 10.

"A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). The Examiner does not rely on Dwilinski alone for teaching crystal growth on planes having an off-orientation angle. The Examiner found Grudowski teaches that improvements in interface quality result from misorienting

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[6] Likewise, Appellants' Specification similarly equates quality and roughness. Spec. 6:8 ("[c]rystal quality also depends on seed surface roughness.").

crystal growth at the surface by 2–9 ^{o}, which falls within the range recited in claim 12. Final Act. 5 (citing Grudowski pp. 3626–27, 6th full ¶).

Furthermore, as set forth above, Appellants do not dispute that Dwilinski identifies a reduced surface roughness as a result of ammonothermal growth on nonpolar surfaces. Reply Br. 7.

The Examiner relied upon these findings to find that a person of ordinary skill in the art at the time of the invention would have attempted crystal growth on a nonpolar m-plane surface misoriented in the c-plane direction with a reasonable expectation of success. Final Act. 5–6. Appellants have not identified reversible error in the Examiner's determination that misorienting crystal growth at the nonpolar surface by 2–9 ^{o} involves the use of a known method to accomplish a predictable result. Such improvements would likely have been obvious. *See KSR*, 550 U.S. at 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.") This is especially true when, as here, the prior art describes a reason for making the modification. *See* Final Act. 5; Ans. 4; *see also* Reply Br. 7.

We, therefore, are not persuaded by this argument.

In view of the foregoing, we affirm the rejection of claims 12, 14–18, and 20–29.

Rejection 2. Claim 19 was rejected as obvious over the combination of Callahan, Dwilinski, Grudowski, and Xu. Final Act. 24. Appellants rely on the same arguments for reversal of this rejection that we previously found

unpersuasive in connection with **Rejection 1**. Therefore, we also affirm the rejection of claim 19.

CONCLUSION

For the reasons provided in the Examiner's Final Office Action and Answer, and above, we affirm the rejections of claims 12 and 14–29 of the '134 Application.

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

AFFIRMED