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MYERS BIGEL & SIBLEY, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

EXAMINER
PHAM, THANHHA S

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte SCOTT SHEPPARD and RICHARD PETER SMITH[1]

Appeal 2015-002471
Application 12/685,910
Technology Center 2800

Before CATHERINE Q. TIMM, JAMES C. HOUSEL, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL[2]

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[1] Appellants identify the real party in interest as Cree Inc., Durham, North Carolina. Appeal Br. 1.

[2] In our opinion below, we reference the Specification filed January 12, 2010 (Spec.), Final Office Action mailed November 7, 2014 (Final), the Appeal Brief filed July 11, 2014 (Appeal Br.), the Examiner's Answer mailed October 27, 2014 (Ans.), and the Reply Brief filed December 29, 2015 (Reply Br.).

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134(a) the Examiner's decision to reject claims 17, 21,[3] 25, and 27–30 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Nihei,[4] and claims 18–20, 22–24, and 26 under 35 U.S.C. § 103(a) as obvious over Nihei in view of Tosuka.[5] We have jurisdiction under 35 U.S.C. §§ 6(b).

We AFFIRM.

The claims are directed to a high electron mobility transistor (HEMT). *See, e.g.*, claims 17 and 27. All of the claims contain a clause concerning the sheet resistance of a barrier layer within the HEMT. It is this clause that is at the center of the dispute between Appellants and the Examiner. *Compare* Final 2–3; Ans. 3–4 *with* Appeal Br. 4–5; Reply Br. 2–3. Claim 17, with the limitation at issue highlighted, is illustrative:

> 17. (Previously Presented) A high electron mobility transistor (HEMT), comprising:
>
> a barrier layer;
>
> a cap layer on the barrier layer;
>
> a gate recess in the cap layer that extends to the barrier layer;
>
> a gate contact in the gate recess, *wherein a sheet resistance of the barrier layer proximate the gate recess is substantially the same after an anneal of the barrier layer, the*

[3] The Examiner mistakenly lists 11 instead of claim 21 in the Final Rejection, but Appellants recognized that it is claim 21 that is rejected. Appeal Br. 3. Thus, the error was harmless.
[4] US 2002/016012 A1, pub. Nov. 7, 2002.
[5] US 2004/0224529 A1, pub. Nov. 11, 2004.

> *cap layer and the gate recess as an as grown sheet resistance of the barrier layer*; and
>
> an encapsulation layer in the gate recess, the encapsulation layer extending between the gate contact and the cap layer such that the gate contact is spaced apart from a surface of the barrier layer opposite an upper surface of the gate contact.

Claims Appendix, Appeal Br. 7 (emphasis added).

OPINION

As Appellants do not argue any claim apart from the others, we select claim 17 as representative for deciding the issue on appeal. The issue is: Have Appellants identified a reversible error in the Examiner's finding that Nihei discloses the same device structure as claimed such that the barrier layer would have a sheet resistance meeting the requirements of claim 17?

Appellants have not convinced us of such an error for the following reasons.

The limitation at issue is directed to the sheet resistance property of the barrier layer proximate the gate recess. Claim 17 recites that the sheet resistance "is substantially the same after an anneal of the barrier layer, the cap layer and the gate recess as an as grown sheet resistance of the barrier layer."

In order to understand the scope of the claim limitation, we turn to the Specification for guidance. "During examination, 'claims . . . are to be given their broadest reasonable interpretation consistent with the specification, and . . . claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art.'"

In re Am. Acad. of Sci. Tech. Ctr., 367 F.3d 1359, 1364 (Fed. Cir. 2004) (quoting *In re Bond*, 910 F.2d 831, 833 (Fed. Cir. 1990)).

The Specification explains that the etching process used to form the recessed gate structure may damage the underlying barrier layer. Spec. 2:25–31. One way to reduce the damage is described in U.S. Application Serial No. 10/758,871[6] and involves providing a low-damage recess through SiN passivation. Spec. 2:31–3:2.

Those in the art have also mitigated high leakage on etched GaN and AlGaN surfaces by annealing at a high temperature after a Schottky metal is deposited. Annealing at 400–600 °C was known to improve high leakage contacts to moderately leaky contacts. Spec. 3:3–7. Appellants disclose annealing at temperatures at least about 700 °C, from about 700 °C to about 900 °C, and in some embodiments, greater than about 900 °C, which they state "may remove damage to the barrier layer **22** that may result from fabrication of the gate recess **36**." Spec. 3:17–20, 14:22–15:5. The Specification further discloses that:

> Thus, for example, the sheet resistance of the region of the barrier layer **22** proximate the gate recess **36** after the high temperature ohmic contact anneal may be substantially the same as the sheet resistance of the region as if the remaining un-etched barrier layer were grown in the reactor.

Spec. 15:1–5.

The Specification also discloses using low damage etching to expose the barrier layer, and describes examples of low damage etch techniques. Spec. 12:17–33, 13:21–22.

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[6] Now US 7,045,404 B2, issued May 16, 2006.

Thus, according to the Specification, etching might damage the barrier layer if a damaging etch is used, and annealing may remove the damage if damage is present.

Claim 17 does not affirmatively require an anneal take place, it only requires a particular property (sheet resistance) that is defined in terms of a comparison of an after-anneal sheet resistance to an as-grown sheet resistance. The portion of the claim clause mentioning annealing is not especially limiting. A prior art reference having a barrier layer that has a sheet resistance substantially the same as an as grown sheet resistance will meet the requirements of the claim, whether the barrier layer was ever subject to annealing or not.

Moreover, neither the claim nor the Specification provide any details about what range of sheet resistances result when growing a barrier layer. The sheet resistance value would depend on the specific growth conditions of the process of growing the layer. Nor is there any guidance on the range of values encompassed by "substantially."

As found by the Examiner, and not disputed by Appellants, Nihei discloses a HEMT having the device structures (barrier layer, cap layer, etc.) required by claim 17. *Compare* Final 2; Ans. 3 *with* Appeal Br. 4–5; Reply Br. 2–3. As found by the Examiner, the barrier layer of Nihei would have a sheet resistance value. Ans. 3. The barrier layer is an electron supplying layer 23 of n-type InAlAs formed on the channel layer 22 with a carrier density of about $2x10^{18}$ cm^{-3} and a thickness of about 25 nm. Nihei ¶ 42. The Examiner's finding that the HEMT of Nihei would have a sheet resistance substantially the same as an as grown sheet resistance is

reasonable given the similarities in the structure of Nihei's device to the structure of Appellants and the breadth of the sheet resistance limitation.

Where patentability rests upon a property of the claimed material not disclosed within the art, the PTO has no reasonable method of determining whether there is, in fact, a patentable difference between the prior art materials and the claimed material. *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977). Therefore, where 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 possess the characteristics of his claimed product. *Id.*

Appellants do not present us with any convincing evidence showing that the HEMT of Nihei would, in fact, have a different sheet resistance than that of claim 17. Appellants argue that "[i]n a conventional device, the formation of ohmic contacts has, typically, required high annealing temperatures (*e.g.* 900 °C). Such high annealing temperatures may damage the materials and/or the device." Appeal Br. 4; Reply Br. 2. But Appellants do not provide any evidentiary support for this statement, and it contradicts statements in the Specification that high annealing temperatures remove damage to the barrier layer, and result in a sheet resistance that is substantially the same as if the remaining un-etched barrier layer were grown in the reactor. Spec. 14:34–15:5.

Appellants have not identified a reversible error in the Examiner's rejection of claims 17, 21, 25, and 27–30 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Nihei.

Appellants do not add any arguments directed to the rejection of claims 18–20, 22–24, and 26 under 35 U.S.C. § 103(a) as obvious over Nihei in view of Totsuka. Thus, Appellants have not identified a reversible error in that rejection.

CONCLUSION

We sustain the Examiner's rejections.

DECISION

The Examiner's decision is affirmed.

TIME PERIOD FOR RESPONSE

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).

AFFIRMED