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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KATSUMI NAKAMURA

Appeal 2018-003253
Application 14/429,337
Technology Center 2800

Before TERRY J. OWENS, CATHERINE Q. TIMM, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

DENNETT, *Administrative Patent Judge*.

DECISION ON APPEAL¹

STATEMENT OF THE CASE

Appellant² appeals under 35 U.S.C. § 134(a) from a rejection of
claims 20–22. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

¹ In our Decision, we refer to the Substitute Specification filed March 18, 2015 (“Spec.”); the Non-final Office Action dated February 14, 2017 (“Non-final Act.”); the Appeal Brief filed May 25, 2017 (“App. Br.”); the Examiner’s Answer dated December 19, 2017 (“Ans.”); and the Reply Brief filed February 2, 2018 (“Reply Br.”).

² Appellant identifies Mitsubishi Electric Corporation as the real party in interest. App. Br. 2.

The invention addresses a problem of semiconductor device manufacture processes being complicated. Spec. ¶ 4. An object of the claimed invention is to provide a semiconductor device capable of stabilizing electrical characteristics while removing a metal impurity and other things in a substrate in a simple way, while maintaining the essential performance of the semiconductor device. *Id.* ¶ 6. Claim 20, reproduced below from the Claims Appendix, illustrates the claimed subject matter:

20. A semiconductor device comprising:
a substrate having a drift layer;
metal wiring formed on an upper surface of the substrate;
and
an electrode formed on a back surface of the substrate,
wherein the lifetime of carriers in the drift layer satisfies
the following expression 1:

[Expression 1]

$$\tau \geq 1.5 \times 10^{-5} \exp(5.4 \times 10^3 t_{N-}) \dots \text{expression 1}$$

τ : the lifetime of carriers in the drift layer [sec]

t_{N-} : the layer thickness of the drift layer [m]

REFERENCES

The Examiner relies on JP 2011-100890 A to Nakayama Koji, published May 19, 2011 (“Koji”) in rejecting the claims on appeal as obvious.

REJECTIONS³

The Examiner maintains and Appellant seeks review of the rejection of claims 20–22 as failing to comply with the enablement requirement of 35 U.S.C. § 112(a)⁴; and the rejection of claims 20–22 under 35 U.S.C. § 103 over Koji. Non-final Act. 2–4; App. Br. 3–5.

OPINION

Rejection of claims as lacking enablement

We need address only the sole independent claim, i.e., claim 20. The Examiner finds that the scope of claim 20 is extremely broad, and includes carrier lifetimes (τ) up to infinity. Ans. 3. The Examiner points out that Appellant’s Figure 19 enables only a subset of carrier lifetimes “necessary for the stabilizing device characteristics, as it pertains to the different thicknesses of N-drift layer [μm] and setting the carrier lifetime to 1.1×10^{-4} or larger, which is represented by a straight line in Figure 19,” and the Specification fails to enable carrier lifetimes up to infinity or beyond the thickness ranges of Figure 19. *Id.* at 4.

Figure 19 is reproduced below from the ’337 Application:

³ In the Answer, the Examiner withdrew the rejection of claims 20–22 as indefinite under 35 U.S.C. § 112(b). Ans. 2.

⁴ Because this application was filed after the 16 March 2013, effective date of the America Invents Act, we refer to the AIA version of the statute.

FIG. 19

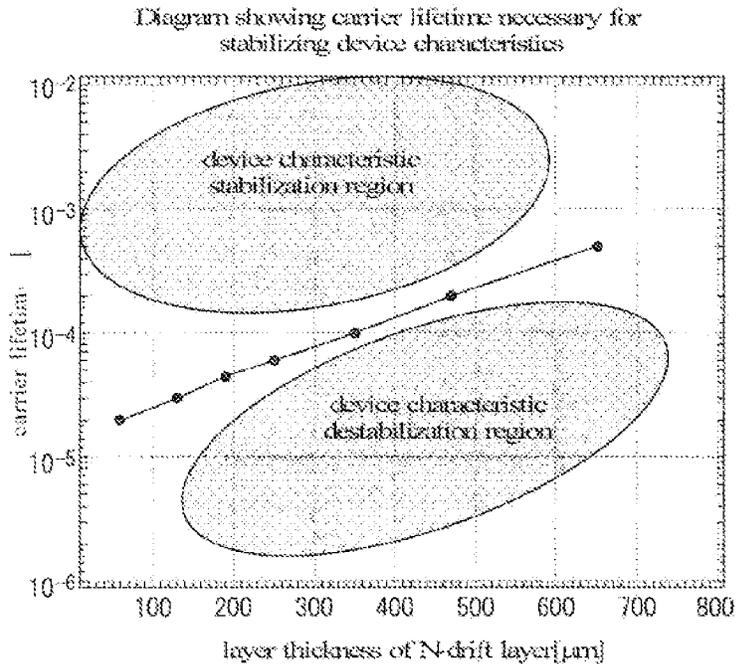


Figure 19 is a diagram showing carrier lifetime necessary for stabilizing device characteristics. Spec. ¶ 11. The carrier lifetime with which the carrier lifetime dependence of $V_{CE(sat)}$ can be reduced was calculated with respect to each of values of the layer thickness of the N^- drift layer and the results plotted on the diagram in Figure 19, with the x-axis being the layer thickness of the N^- drift layer in μm and the y-axis being the carrier lifetime in μsec on a logarithmic scale. *See id.* ¶ 35. For example, when the layer thickness of the N^- drift layer is 400 μm , $V_{CE(sat)}$ can be stabilized by setting the carrier lifetime to 1.1×10^{-4} seconds or larger. *Id.* The lifetimes of carriers in a “device characteristics stabilization region” in Figure 19 satisfy the equation in claim 20:

$$\tau \geq 1.5 \times 10^{-5} \exp(5.4 \times 10^3 t_{N^-}) \dots \text{expression 1}$$

τ : the lifetime of carriers in the drift layer [sec]

t_{N^-} : the layer thickness of the drift layer [m]

See id. ¶¶ 35–36.

“Although not explicitly stated in section 112, to be enabling, the specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without ‘undue experimentation.’”. *See In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993). The Examiner bears the initial burden of setting forth a reasonable explanation as to why the scope of protection provided by a claim is not adequately enabled in the specification. *Id.* at 1561–62. Here, the Examiner does not meet the burden.

During prosecution, an application’s claims are given their broadest reasonable scope consistent with the specification. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). The words used in a claim must be read in light of the specification, as it would have been interpreted by one of ordinary skill in the art at the time of the invention. *Id.* One of ordinary skill in the art at the time of the invention reasonably would not have interpreted claim 20 as including infinite carrier lifetimes as concluded by the Examiner (Ans. 3, 5, 6) which, according to claim 20’s Expression 1, require drift layers of infinite thickness. The skilled artisan would reasonably infer that limits to the thickness of the drift layers are implicit. Thus, the claims are not as broad as determined by the Examiner and the Examiner has failed to provide a reasonable explanation as to why undue experimentation would be required by the ordinary artisan to make and use the full scope of semiconductor devices encompassed by the claims as correctly interpreted.

Appellant's arguments identify reversible error in the Examiner's rejection. We reverse the Examiner's rejection of claim 20, and, for the same reasons, the rejection of claims 21 and 22.

Rejection of claims as obvious over Koji

Koji discloses a carrier lifetime of "15 microseconds or more." Koji ¶ 27. Thus, Koji teaches the desire for a longer carrier lifetime. However, Koji does not teach how to accomplish this goal. The Examiner does not establish that Koji's disclosure of a device with a "carrier lifetime for 15 microseconds or more" and a drift layer thickness of "not less than 300 micrometers," would have indicated to one of ordinary skill in the art how to produce semiconductor devices that meet the requirements of the expression in claim 20.

The Examiner reversibly errs in concluding that claim 20 is obvious over Koji. For the same reasons, claims 21 and 22 are not obvious.

The Examiner reversibly errs in concluding that claim 20 is obvious over Koji. For the same reasons, claims 21 and 22 are also not obvious

DECISION

For the above reasons, the Examiner's rejection of claims 20–22 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).

AFFIRMED