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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MICHAEL JOHN O’LOUGHLIN, LIN CHENG,
ALBERT AUGUSTUS BURK, JR., and ANANT KUMAR AGARWAL¹

Appeal 2015-005987
Application 13/610,993
Technology Center 2800

Before BRADLEY R. GARRIS, JAMES C. HOUSEL, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134, Appellants appeal from the Examiner’s rejections under 35 U.S.C. § 103(a) of independent claims 1 and 20 as unpatentable over Tsuchida et al. (US 2009/0039358 A1, published Feb. 12, 2009) (“Tsuchida”) and dependent claims 2–10, 13–19, and 23–35 as unpatentable over this reference alone or in combination with an additional prior art reference. We have jurisdiction under 35 U.S.C. § 6.

¹ Cree, Inc. is identified as the real party in interest. App. Br. 1.

We AFFIRM.

Appellants claim a method and a semiconductor die wherein a carbon vacancy reduction material is ion implanted into a silicon carbide epitaxial structure followed by annealing to diffuse carbon atoms substantially throughout the epitaxial structure “such that an average carrier lifetime in the silicon carbide epitaxial structure is at least three times an average carrier lifetime in the silicon carbide epitaxial structure before ion implanting the carbon vacancy reduction material” (independent claims 1 and 20).

A copy of representative claims 1 and 20, taken from the Claims Appendix of the Appeal Brief, appears below.

1. A method comprising:
providing a substrate;
forming a silicon carbide epitaxial structure on the substrate;
ion implanting a carbon vacancy reduction material into a surface of the silicon carbide epitaxial structure; and
annealing the silicon carbide epitaxial structure to mobilize the carbon vacancy reduction material to diffuse carbon atoms substantially throughout the silicon carbide epitaxial structure, such that an average carrier lifetime in the silicon carbide epitaxial structure is at least three times an average carrier lifetime in the silicon carbide epitaxial structure before ion implanting the carbon vacancy reduction material.

20. A semiconductor die comprising:
a substrate; and
a silicon carbide epitaxial structure on the substrate and comprising carbon vacancy reduction material, which has been implanted into a surface of the silicon carbide epitaxial structure, wherein the silicon carbide epitaxial structure has been annealed to mobilize the carbon vacancy reduction material to diffuse carbon atoms substantially throughout the silicon carbide epitaxial structure, such that an average carrier lifetime in the silicon carbide epitaxial structure is at least three times an average carrier lifetime in the silicon carbide epitaxial structure before ion implanting the carbon vacancy reduction material.

Appellants do not present separate arguments specifically directed to the dependent claims under rejection (App. Br. 5–8). Therefore, the dependent claims will stand or fall with their parent independent claims 1 and 20.

We sustain the rejections before us for the reasons expressed in the Final Action, the Answer, and below.

The Examiner finds that Tsuchida discloses ion implanting a carbon vacancy reduction material into a silicon carbide epitaxial layer followed by annealing in order to improve carrier lifetime of the silicon carbide layer (Final Action 4–5 (citing, e.g., ¶ 33)). Appellants do not dispute this finding (*see generally* App. Br.). Instead, Appellants argue that “*Tsuchida* does not disclose or suggest annealing a silicon carbide epitaxial structure such that an average carrier lifetime is at least three times an average carrier lifetime in the silicon carbide epitaxial structure before ion implanting a carbon vacancy reduction material” (App. Br. 5). In this regard, Appellants emphasize that Tsuchida discloses “an average carrier lifetime doubles” (*id.* at 7 (citing at n. 17 Tsuchida Fig. 18)) and that “embodiments of the present invention, which triples an average carrier lifetime, achieves the carrier lifetime using parameters [e.g., annealing temperature] disclosed in *Tsuchida* where a carrier lifetime disclosed in *Tsuchida* only doubles” (*id.*).

In response, the Examiner points out that the general trend for improving average carrier lifetime is known in Tsuchida (Ans. 2–3) and that under the same or similar conditions (e.g., annealing temperature) Tsuchida’s silicon carbide epitaxial structure “must behave in the same way as the applicant’s as far as the average carrier lifetime is concern[ed]” (*id.* at 3).

As explained in *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. 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.

(Internal citations and footnote omitted.)

The record reflects that Tsuchida teaches or would have suggested the identical or substantially identical materials and process parameters used to obtain the claimed average carrier lifetime, and Appellants do not argue otherwise (*see generally* App. Br.). These circumstances support the Examiner’s above determination that Tsuchida’s silicon carbide epitaxial structure must behave in the same way as Appellants’ identical structure, when each is subjected to the same processing conditions. When so processed, the epitaxial structure of Tsuchida necessarily and inherently would possess the same average carrier lifetime improvement as the claimed structure.

Appellants argue that the Examiner “is relying on possibilities, or, at best probabilities, in order to maintain the rejection” (Reply Br. 4).

We do not agree. It is well-settled that the prior art need only meet the inherently disclosed limitation to the extent the claimed invention does. *King Pharms., Inc., v. Eon Labs, Inc.*, 616 F.3d 1267, 1276 (Fed. Cir. 2010). For the reasons previously explained, the epitaxial structure of Tsuchida necessarily or inherently would possess the claimed average carrier lifetime

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to the same extent as the claimed epitaxial structure (i.e., to the extent these same structures are processed in the same way).

In summary, Appellants fail to reveal error in the § 103 rejection of independent claims 1 and 20 as unpatentable over Tsuchida.

The decision of the Examiner 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).

AFFIRMED