Paper No. 19

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INNOSCIENCE (ZHUHAI) TECHNOLOGY COMPANY, LTD., AND INNOSCIENCE AMERICA, INC.,
Petitioner,

v.

EFFICIENT POWER CONVERSION CORPORATION,
Patent Owner.

IPR2023-01384
U.S. Patent 10,312,335

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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*Emphasis added unless otherwise noted.

I. Introduction

The Patent Owner Response contradicts the disclosure of the references and the law of obviousness. Patent Owner implausibly argues that one change of *Saxler* that the reference itself discloses—removing the gate recess—renders the device inoperable. Paper No. 17 ("POR"), 16-22. And Patent Owner contends this modification does not result in an enhancement mode device when Patent Owner agrees a HEMT with a p-type gate—like *Saxler*—is enhancement mode. POR, 7-8, 16-22.

Patent Owner acknowledges drawings in *Saxler* and *Yoshida* show "ledges having substantially equal widths" as recited in claim 1 but incorrectly argues those drawings cannot be used under Federal Circuit precedent. POR, 29-38. This misunderstands the law, for "substantially equal" is an imprecise term of degree and drawings may disclose it.

In addition, Patent Owner repeatedly applies the law of anticipation, not obviousness, to rebut the Petition. POR, 17-18, 81-82.

These and other errors show the '335 patent is unpatentable over the asserted grounds.

II. Level of Skill in Art

Although the parties disagree on the level of ordinary skill, the differences do not impact the analysis. POR, 8-9; Paper No. 1 ("Petition"), 18.

III. Statement of Facts

Patent Owner did not deny any fact in the Statement of Material Facts, which are thus all admitted. POR, 8; *AVX Corp. v. Presidio Components, Inc.*, IPR2018-00292, Paper No. 16 at 9 (P.T.A.B. May 15, 2019). Instead, Patent Owner sidestepped the merits by asking the Board to "ignore[]" the Statement because it did not cite the record. POR, 8. This misunderstands the law. A Statement "*preferably*" cites the record, but the law does not require citations. 37 C.F.R. § 42.22(c).

Regardless, the Petition *did* identify the '335 patent itself admits facts 1.a-1.f. *Compare* Petition, 8-9 with *id.*, 17-18; *see* Ex. 1001, 1:21-2:30, Figs. 1-2, 3A-3B, claims 1-7; Ex. 1003 ("Shealy"), [044]. The Petition also noted self-aligned gate structures were common, discussing *Beach* and citing Dr. Shealy, for example, as evidence of fact 2. *Compare* Petition, 7, 57 with *id.*, 18. Patent Owner did not—and cannot—dispute these facts.

IV. *Saxler* renders obvious an enhancement mode GaN transistor based on Figure 1A (Ground 1)

A. It would have been obvious to remove the recess of Figure 1A to achieve an enhancement mode device

The Petition presented *Saxler*'s Figure 1A without a gate recess as *Saxler* describes, which is an enhancement mode transistor with a p-type GaN layer. Petition, 25-26; Shealy, [090]-[091], [108]. Patent Owner agrees a HEMT with a p-type gate is enhancement mode. POR, 7-8.

Saxler states "[e]xemplary devices … are schematically illustrated in FIGS. 1A through 6," and "while embodiments of the present invention are described herein with reference to a recessed gate structure or a non-recessed gate structure, other embodiments of the present invention ***may include or not include*** a gate recess." *Saxler*, [0052]. This tells a POSITA some embodiments based on Figure 1A ***would not*** include a gate recess. Petition, 25-26; Shealy, [090]-[091], [108]; Ex. 2004, 31:1-20, 37:7-21. A POSITA would have had good reason to remove the recess: "to turn *Saxler*'s device into an enhancement mode device, thus realizing the benefits of reduced power consumption and suitability for high power applications." Petition, 33; Shealy, [103] (citing Ex. 1029, 1).[1]

Patent Owner wrongly contends *Saxler* discloses distinct embodiments, one with a gate recess (Fig. 1A) and one without (Fig. 1B). POR, 16-22; Ex. 2005, ¶¶81-112. But, describing alleged differences between *Saxler*'s recessed and non-recessed embodiments, Patent Owner actually identifies many similarities. POR, 18-20. The POR identifies thickness ranges of cap layers, doped regions, and high Al regions that overlap recessed and non-recessed embodiments. *Id.* (e.g., 5-20Å cap layer in

[1] The declaration at [103] mistakenly cited "*Suh*, 1" (Ex. 1017) to refer to *Suh2006* (Ex. 1029). Either reference supports the motivation. *Compare* Ex. 1017, [0002], [0005] (discussing benefits) *with* Ex. 1029, 1 (same).

recessed and non-recessed). Patent Owner also irrelevantly cites example ***n***-type dopant concentrations of "10^{18} to about 10^{21} cm^{-3}" in recessed embodiments and exceeding 10^{21} cm^{-3} in non-recessed embodiments. POR, 20; *Saxler* [0012]. For ***p***-type dopants, concentrations range from "10^{16} to about 10^{22} cm^{-3}" for both recessed and non-recessed caps. *Saxler*, [0013], [0071].

Patent Owner nonsensically argues *Saxler* [0052] does not mean what it says because the "other embodiments" without a recess refer to Figure 1B. *Id.*, 22. EPC's expert Dr. Schubert further contends without basis paragraph [0052] does not mean what it says because it was "written by a patent attorney." Ex. 2005, ¶101. No reasonable reading of [0052] restricts "other embodiments" to those shown in Figures 1A to 6. This passage expressly acknowledges *Saxler*'s recess is optional in every figure. In view of this statement and the knowledge of a POSITA, it would have been obvious to remove Figure 1A's recess to make an enhancement mode device. Petition, 33; Shealy, [103].

Patent Owner is wrong that the Petition engaged in hindsight when modifying Figure 1A. POR, 21. Patent Owner relies on Dr. Shealy's testimony that a POSITA would "mix and match" and "take all the embodiments and bring in which ones you want, depending on what you're trying to accomplish." POR, 21 (citing Ex. 2004, 39:3-5 while quoting *id.*, 41:24-42:1), 58. But ***Saxler itself*** tells a POSITA to remove Figure 1A's recess. *Saxler*, [0052]. Following its guidance is not hindsight.

B.F. Goodrich Co. v. Aircraft Braking Sys. Corp., 72 F.3d 1577, 1583 (Fed. Cir. 1998) (upholding single-reference obviousness for explicit suggestion to modify); *Boston Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009).

Dr. Shealy's testimony accurately reflects obviousness law. His statement a POSITA "could take all the embodiments" accords with the principle that prior art must be considered for "everything it teaches." *EXP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). His statement a POSITA would "bring in which [embodiments] you want, *depending on what you're trying to accomplish*," acknowledges one may combine the teachings of the prior art with reason to do so. *KSR Intn'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 401-402 (2007); *Boston Sci.*, 554 F.3d at 991. Dr. Shealy provided a reason to remove Figure 1A's recess: to accomplish the benefits of enhancement mode. Shealy, [103]. The benefits of enhancement mode were well known, and Dr. Shealy's analysis adheres to *KSR*.

Patent Owner, in contrast, lacks legal support for its position one cannot combine *Saxler*'s embodiments. POR, 17-18 (discussing *Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1063 (Fed. Cir. 2017), *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008)). Patent Owner's cases address ***anticipation***, where a reference must disclose the claim in its exact configuration, not ***obviousness***. POR, 17-18; *Microsoft*, 878 F.3d at 1063-64; *Net MoneyIN*, 545 F.3d at 1369. Obviousness

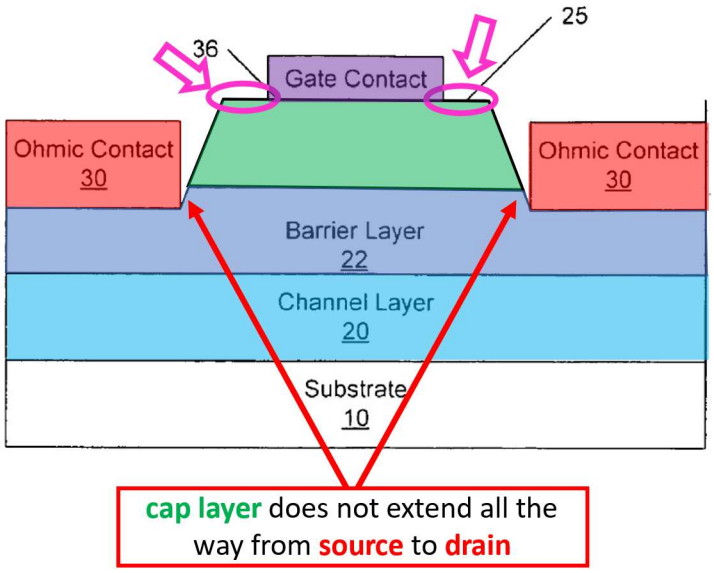
allows predictable combinations of embodiments, especially where, as here, the reference explicitly instructs it. *Boston Sci.*, 554 F.3d at 991.

Dr. Schubert also contradicts the law. He opined "it is only reasonable to consider that the disclosure of Saxler must be 'limited' to what is actually disclosed" and because *Saxler* allegedly never combines recessed and non-recessed embodiments, a POSITA would not have removed *Saxler*'s recess. Ex. 2005, ¶102; *see id.* ¶¶101-112. *KSR* rejected Dr. Schubert's rigid understanding. 550 U.S. at 418 (obviousness accounts for "inferences and creative steps"), 422 (A POSITA "is also a person of ordinary creativity, not an automaton.").

Petitioners' proposed modification simplifies *Saxler*'s Figure 1A by removing steps to form a recess in its gate. *Saxler*, [0065]; Petition, 25-26, 33; Shealy, [089]-[091], [103]. It does not require "additional process steps ... to get from Figure 1B to the modified figure" as Patent Owner contends (POR, 22) because the Petition never proposed starting from Figure 1B. The modification starts with Figure 1A.

B. The proposed modification of *Saxler* would operate as an enhancement mode device

Patent Owner incorrectly contends *Saxler*'s modified Figure 1A would be inoperable in enhancement mode because its **cap layer** purportedly extends from **source** to **drain**. POR, 22-26. The proposed modification, highlighted below, plainly shows otherwise. The **barrier layer** separates the **cap layer** from **source** and **drain**.

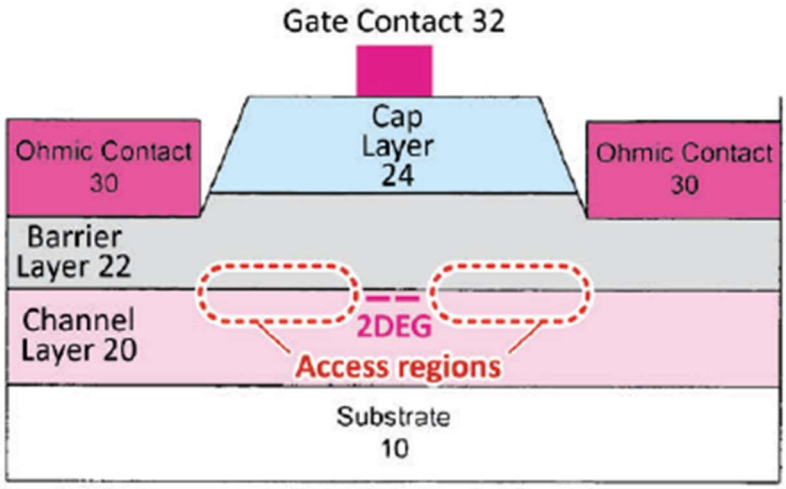


Petition, 26; Shealy [091].

For this argument, Patent Owner conducts an irrelevant analysis of Figure ***1B***, not 1A, whose cap layer abuts source and drain. POR, 23-26. This misunderstands the modification, which removes the recess of Figure 1A. Petition, 25-26, 33, 39-41. As Dr. Shealy testified, Figure 1B could not be fabricated as drawn and "would be a disaster" if the **cap layer** was conductive because "there would always be current flowing … from drain to source that would be going through the cap layer that wouldn't be affected, necessarily, by the gate," and "you never want a parallel

conduction path to the [2DEG]." Ex. 2204, 63:12-12, 65:16-18.[2] The Petition and Dr. Shealy never suggested Figure 1A's **cap layer** extends from **source** to **drain**.

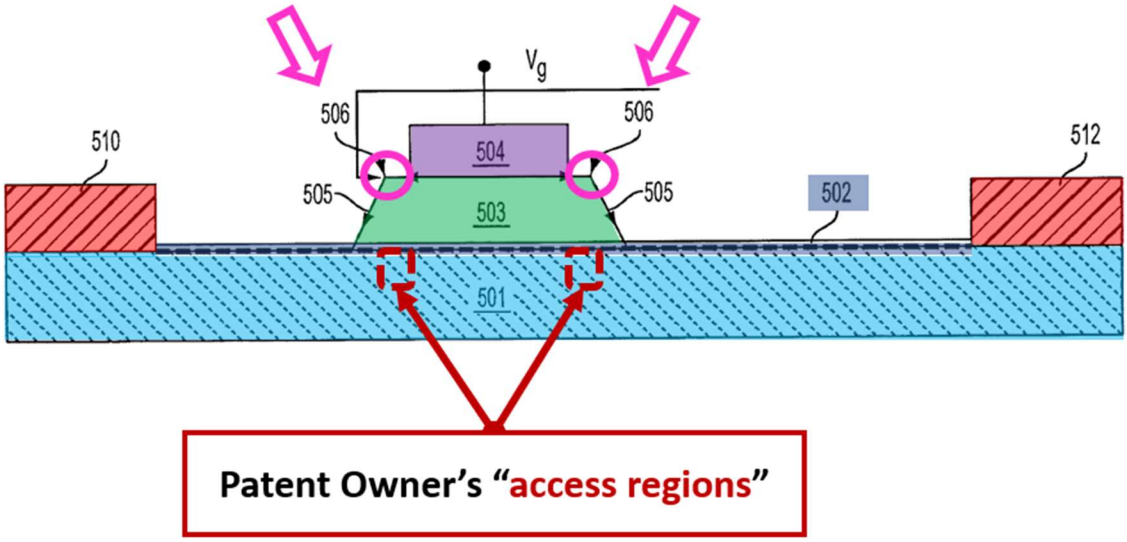
Patent Owner and Dr. Schubert also argue the cap layer of modified Figure 1A is "substantially from source to drain" and cannot function as an enhancement mode device because the 2DEG remains depleted under positive voltage. POR, 25-26; Ex. 2005, ¶122. They assert "geometry" causes "access regions" below *Saxler*'s horizontal ledges on its p-GaN layer to "remain depleted of free electrons … even for positive gate voltage." POR, 25; Ex. 2005, ¶122.



[2] Patent Owner alleges Dr. Shealy "contradicted himself" in testifying Figure 1B could be enhancement mode. POR, 23. But he stated it would be enhancement mode when "separat[ing] the Ohmics from the cap layer," which avoids parallel conduction paths. Figure 1A. Ex. 2004, 65:12-18. This is no contradiction.

Id.[3]

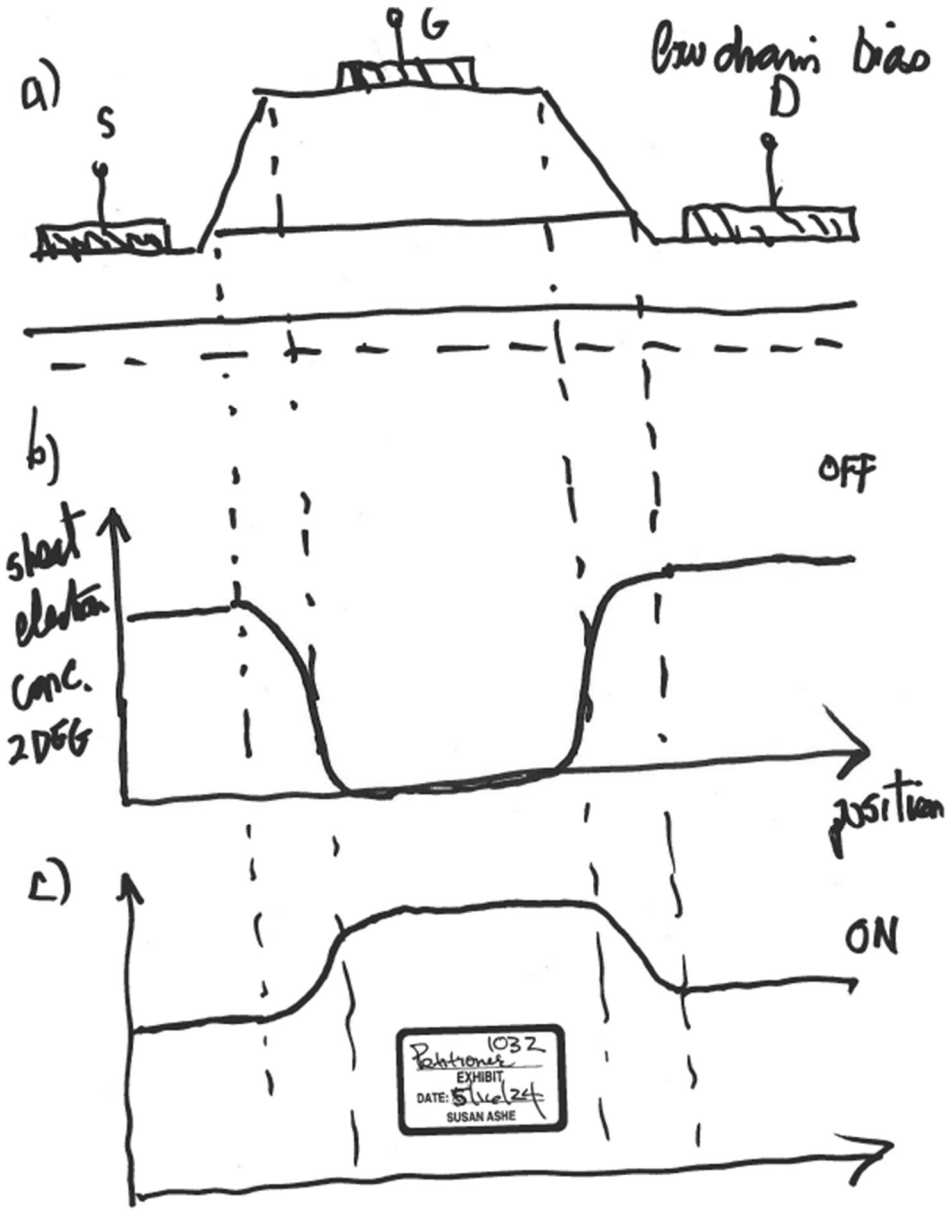
Patent Owner's argument contradicts the '335 patent. The patent has the same "access regions," and it purports to operate in enhancement mode. Ex. 1001, Fig. 5, claims 1-7. Patent Owner and Dr. Schubert do not explain this contradiction. POR, 25; Ex. 2005, ¶122.



Petition, 1 (showing Ex. 1001, Fig. 5).

Patent Owner ignores Dr. Shealy's detailed explanation and drawing describing how Figure 1A is in enhancement mode when "the recess is removed and p-dopants are added to the capping layer." Ex. 2004, 104:9-105:19; Ex. 1032.

[3] Patent Owner modifies Figure 1A to shrink gate metal width when depicting this "geometry." *Compare* Ex. 2005, ¶122 (here) with Shealy, [091] (above).



Ex. 1032. In the "off" condition, a 2DEG forms under source and drain but is depleted gradually in the cap's sloped region until fully depleted under the horizontal ledges. Ex. 2004, 104:2-18; Ex. 1032 ("b"). In the "on" condition, at "a reasonable level" voltage, a 2DEG forms under the cap at concentrations exceeding electron concentration below source and drain. Ex. 2004, 104:19-105:10; Ex. 1032 ("c").

Patent Owner and its expert do not address this analysis, instead referencing irrelevant testimony of a different expert in a different proceeding on a different prior art reference with a different "geometry." POR, 26-28; Ex 2004, ¶¶123-127.¶

Patent Owner's contorted argument that *Saxler's* p-type dopants function as "deep level dopants" does not save the claims. POR, 24-25; Ex. 2005, ¶128. This analysis relies on *Saxler* [0049], which describes "particular embodiments" where the cap layer has high dopant concentration at its outer surface. Ex. 1007, ¶49. In these embodiments, "dopants at the outer surface may segregate to dislocations in the cap layer and, thereby reduce gate leakage along the dislocations," and "may have characteristics of a deep level when at a dislocation." *Id.* But *Saxler* never says p-type dopants do not function as shallow dopants at *other* locations. *Id. Saxler* specifically clarifies its "references to p-type ... dopants refer[] to the characteristics of the dopants *in the bulk crystal rather than when at a dislocation*." *Id.* When *Saxler* describes p-typed doping in a sub-region or when doped throughout its cap layer (e.g., *Saxler*, [0013], [0069] [0071]), it describes shallow dopants in the bulk crystal, capable of depleting the 2DEG when the recess is removed. Petition, 25, 35-36; Shealy, [090], [108]-[0109].

V. A POSITA Would Have Combined *Saxler* and *Yoshida*, which renders obvious an "enhancement mode" device (Grounds 2-3)

Patent Owner contends a POSITA would not have removed the recess of *Saxler*'s Figure 1A over *Yoshida* for the same flawed reasons as for *Saxler* alone. POR, 45-47. As explained, that is incorrect. *Supra* §IV.

Patent Owner again mistakenly claims *Saxler* has "divergent parameters" for recessed and non-recessed embodiments. POR, 46, 47. But it relies on passages showing example parameter ranges that ***overlap*** both gate types and overlooks that *Saxler* uses the same p-type concentrations for both gate types. POR, 47 (citing *Saxler*)[4]; *supra* § IV.A. These passages thus do not show mutually exclusive recessed and non-recessed embodiments, especially in view of *Saxler* [0052]. *Supra* §IV.A.

Patent Owner's argument rests on the false premise that "depletion-mode transistors have completely different structure, function, and applications from enhancement-mode" and the combination alters *Saxler*'s "principle of operation." POR, 46; Ex. 2005, ¶¶35, 185. But Dr. Shealy explained the two devices have the same layer composition, and after removing *Saxler*'s recess when its cap is doped p-type (as both references disclose), Figure 1A would function in enhancement mode. Shealy, [098]-[106]; Petition, 29-35. Dr. Shealy testified "they're very compatible

[4] Petitioners understand the citation to Ex. 1017 refers to *Saxler* (Ex. 1007).

with each because they only differ by, you know, that one feature to go from a depletion mode to an enhancement mode" and the same POSITA "would be familiar with both" devices. Ex. 2004, 65:23-11; Ex. 1001, 1:23 (field of invention "relates generally to transistors.").

Patent Owner's reliance on *In re Ratti* is inapposite. POR, 46; 270 F.2d 810, 813 (C.C.P.A. 1959). There, the C.C.P.A. declined to combine references that "require[d] a substantial reconstruction and redesign" along with "change[s] in the basic principles" of operation. *In re Ratti*, 270 F.2d at 813. Here, a POSITA would have readily understood a simple substitution of *Saxler*'s recessed gate with *Yoshida*'s non-recessed gate in a p-type embodiment of Figure 1A would have predictably achieved enhancement mode. Petition, 25, 32-36; Shealy, [090], [102]-[106], [108]-[0109]. This does not change the "principle of operation"—*Saxler* teaches its recess is optional—and the Petition identified ample motivation to make the proposed combination, including simplifying manufacturing, decreasing costs, and receiving the benefits of a normally-off device suitable for high power applications. Petition, 32-36; Shealy, [102]-[106].

VI. *Saxler* and *Yoshida* disclose "ledges having substantially equal widths" (All Grounds)

A. There is no dispute *Saxler* and *Yoshida* show "ledges having substantially equal widths," and there is no reason to limit this term to "nanometer widths"

Patent Owner agrees *Saxler* and *Yoshida* depict "ledges having substantially equal widths" on either side of the gate as recited in claim 1. POR, 3 ("Uemoto, like Saxler and Yoshida, represents the transistor with schematics illustrating a gate with a centrally aligned electrode contact."); Paper No. 7 at 26, 32. To circumvent this admission, Patent Owner limits "substantially equal" to arbitrary differences within nanometers that allegedly could not be depicted in schematics of *Saxler* and *Yoshida*. POR, 30-31, 32-33. Patent Owner presents no claim construction, *id.*, 7-8, and provides no reason to limit the term, *id.* 30-31, 32-33.

Patent Owner compares ledges in the '335 patent's TEM image, which allegedly vary by just 1 nm, to ledges in *Uemoto*'s TEM image, which allegedly vary by 68%. POR, 29-31. The POR then suggests only the patent's "self-aligned structures" can create "substantially equal" ledges. *Id.* But claim 1 does not require self-alignment. Self-alignment appears in dependent claim 2, so there are other ways to make "substantially equal" ledges. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314-15 (Fed. Cir. 2005). The TEM image does not limit the scope of the claim. *Hill-Rom Servs. Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371-72 (Fed. Cir. 2014) (quoting *Liebel-Flarsheim v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004)). The patent

lists no range for "substantially equal," much less a nanometer range. POR, 30; Ex. 1001.

Further, *Uemoto* is irrelevant. The Petition did not assert *Uemoto* in any ground. The fact that it happens to draw a centered gate and build an offset gate does not mean the '335 patent's "substantially equal" requirement should be limited to any particular dimension. Moreover, Uemoto's disclosure of unequal ledges in TEM images does not diminish its concurrent disclosure of "substantially equal" ledges in a schematic nor diminish *Saxler*'s and *Yoshida*'s substantially equal ledges.

B. *Hockerson* does not apply to "substantially equal"

Because *Yoshida* and *Saxler* admittedly depict "substantially equal" ledges, Patent Owner argues their drawings cannot be relied on under *Hockerson-Halberstadt, Inc. v. Avia Group. Int'l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000). POR, 29-38, 59-60. *Hockerson* does not apply to this term. Paper No. 8 at 2-5; Petition, 51, 83.

Hockerson does not extend to relative proportions, terms of degree, and approximation. Paper No. 8 at 2. Petitioners showed "substantially equal" is an approximation or term of degree, which the POR does not dispute. *Id.* at 4 (citing *Seattle Box Co., Inc. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984); M.P.E.P. § 2173.05(b)(II)(D)); POR, 31-35 (no discussion of *Seattle Box* or M.P.E.P.). *Hockerson* does not apply.

Patent Owner misreads *Ex parte Bjorn*, arguing it follows *Hockerson* for a "substantially equal" requirement. POR, 32; No. 2018-001567, 2019 WL 6173305 (P.T.A.B. Oct. 16, 2019). There, claim 1 required a thread diameter of an "abutment" of a bone implant to be "less than or substantially equal to" a screw diameter. *Ex Parte Bjorn*, 2019 WL 6173305 at *1. *Ex Parte Bjorn* first found *Hockerson* did not apply because "no particular dimensions" were claimed. *Id.* at *10-11. The Board then found numerous prior art figures not to scale from different references disclosed "substantially equal" diameters. *E.g.*, *id.* at *11 (e.g., noting certain figures show "diameters ***substantially equal***" and still others "clearly show ... substantially equal" diameters), 17 (certain figure "clearly illustrates ... substantially equal" diameters). Here, the Board did not find the prior art showed "less than ... equal" diameters—the prior art showed "substantially equal" diameters. *Id.*

Patent Owner's misplaced criticism of *In re Bjorn* focuses on an analysis of a figure with an abutment diameter clearly ***larger*** than the screw. *Id.* at 17; POR, 32. The Board questioned whether this ***larger*** diameter disclosed "substantially equal" and reasoned it needed to calculate whether the size difference fell within an acceptable percentage. *Ex Parte Bjorn*, 2019 WL 6173305 at *17. Because that analysis required a precise proportion, the Board decided *Hockerson* applied. *Id.* But its decision related solely to that specific figure—when figures not to scale "clearly

illustrate[d]" substantially equal diameters, the Board did not apply *Hockerson* and upheld rejections over drawings. *Id.* at *10-11, 17.

Patent Owner fails to distinguish Petitioners' caselaw. POR, 33-35. Petitioners identified cases showing *Hockerson* does not apply to terms involving spatial relationships not of precise proportions or sizes. Paper No. 8 at 2-5. The POR contends those cases do not apply because they involved different claim terms, but it agrees the cases involved imprecise spatial relationships. POR, 33-35.

"Substantially equal" is an imprecise approximation or term of degree, so *Hockerson* does not apply. Paper No. 8 at 4. And there is no dispute that *Saxler* and *Yoshida* depict substantially equal ledges. POR, 3; Paper No. 7 at 26, 32. Where, as here, a drawing depicts "substantially equal ledges," it discloses the limitation. *Ex Parte Bjorn*, 2019 WL 6173305 at *11, 17.

C. *Hockerson* does not apply to claim 7's "symmetric" ledges

The Board invited the parties to address whether *Hockerson* applies to claim 7's "symmetric" ledges. Paper No. 11 at 38. Patent Owner declined to do so and did not dispute that the prior art renders obvious this limitation. POR, 29-38 (no discussion of claim 7), 44-45 (same), 59-60 (same), 62-63 (same). Any such arguments are forfeited. *Google LLC v. Uniloc 2017 LLC*, IPR2020-00447, Paper 24 at 13-14 (P.T.A.B. May 11, 2021). Regardless, the patent explicitly equates "substantially equal widths" with "symmetric" ledges. Ex. 1001, 3:59-64.

Petitioners' analysis herein thus applies should Patent Owner belatedly argue *Hockerson* applies to claim 7. *Supra* §VI.B.

D. *Saxler*'s drawings render obvious "substantially equal" ledges (Grounds 1-3)

Patent Owner incorrectly contends *Saxler* does not render obvious a structure it concedes *Saxler* shows—substantially equal ledges—because its drawings are imprecise. POR, 35-38. Patent Owner alleges the Petition tries to "have it both ways" by relying on drawings in some ways while acknowledging their shortcomings in others. *Id.* That is a false dilemma—either *Saxler*'s drawings can be relied on for exactly what they depict or they cannot be relied on at all. POR, 36-37.

A POSITA faced no such dilemma because a POSITA is "a person of ordinary creativity, not an automaton" who can assimilate information in the reference with knowledge of the art. *KSR*, 550 U.S. at 418, 422. A POSITA would have understood *Saxler*'s drawings were imprecise and inaccurate in some ways. Ex. 1007, [0042]; EX2001, 53:13-25, 56:26-57:1. A POSITA knew vertical sidewalls may have been sloped when implemented in practice, as *Saxler* itself states. Ex. 1007, [0042]; Petition, 76; Shealy, [204]. This does not mean a vertical sidewall would ***not*** have been obvious.

A POSITA would have seen Figure 1A shows a centered gate with ledges of substantially equal width and found such a gate obvious. Petition, 51, 83. Patent Owner suggests a symmetric gate would ***not*** have been obvious because other gates,

like an offset gate, were also described. POR, 35-38. The POR cites *Saxler* [0065], which uses non-limiting language ("the recess may be offset") to describe an optional feature, which means other embodiments—like Figure 1A—would not have an offset. POR, 37-38. Further, *Saxler* [0065] does not describe the relationship between the gate electrode and *cap layer* which defines the widths of the claimed ledges. It describes the spatial relationship between the gate and *source/drain*. Ex. 1007, [0065]. That *Smith* likewise describes offset embodiments does not limit *Saxler* to those embodiments. POR, 37; Ex. 1015, [0041]-[0042].

E. *Yoshida* renders obvious "ledges having substantially equal widths" (Grounds 4-6)

The Petition showed *Yoshida*'s Figure 1 discloses ledges of substantially equal widths ([1f]), and the claim was obvious over *Yoshida* alone (Ground 4). Petition, 81-82. Grounds 5-6 alter *Yoshida*'s gate structure to incorporate *Saxler*'s sloped sidewalls but otherwise retain *Yoshida*'s structure, including its ledges. Petition, 67-71. Thus, the Petition need not present any "additional reasoning" for the *Yoshida-Saxler* combination as Patent Owner argues. POR, 62. Grounds 4-6 rely on *Yoshida*'s substantially equal ledges for [1f]. *Id.*, 67-71, 81-82.

VII. The "self-aligned ledges" of claims 2 and 5 are product-by-process limitations (All Grounds)

The "self-aligned ledges" of claims 2 and 5 are product-by-process limitations that carry no patentable weight. Pet., 23-24. Patent Owner fails to identify any

structural features that uniquely derive from a "self-aligned" process. POR, 38-44. Patent Owner alleges this process imparts "substantially equal" (symmetric) ledges and a "minimum CD" (critical dimension) of the gate metal (its width).[5] *Id.* But the patent acknowledges that other methods can achieve these results.

First, claim differentiation shows other methods can create symmetric ledges. *Phillips v. AWH Corp.*, 415 F.3d at 1314-15. Dependent claim 2 calls for "self-aligned" ledges but claim 1 has "substantially equal" ledges without requiring a self-aligned process.

Second, the patent states a two-mask process may result in "the ***possibility*** of misalignment," as the Board noted. Paper 11 at 18-19; Ex. 1001, 4:52–63. This means the two-mask process may also result in alignment. And the patent states the two-mask process "etch[es] the gate metal to a minimum CD." Ex. 1001, 4:57-58.

The intrinsic record thus shows other methods can create a symmetric gate structure with a "minimum CD." Dr. Schubert's contrary arguments should be given no weight. POR, 38-42; Ex. 2005, ¶¶48-52. "[E]xpert testimony may not be used to

[5] The patent provides no examples of a "minimum CD" nor explain how to determine whether a gate indeed has achieved a "minimum." If, as Patent Owner contends, "minimum CD" is a structural feature the "self-aligned" requirement imposes, the claim would be indefinite under 35 U.S.C. § 112(b).

diverge significantly from the intrinsic record." *Genuine Enabling Tech. LLC v. Nintendo Co., Ltd.*, 29 F.4th 1365, 1373 (Fed. Cir. 2022); *Phillips*, 415 F.3d at 1318 ("[A] court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent.") (citation and quotation marks omitted).

As Dr. Shealy's testified, "without self-alignment, it's certainly possible to use lithographic techniques and place [the gate metal] in the center [of the cap layer], yes." Ex. 2004, 57:3-7; Shealy, [060]. That testimony remains unrebutted.

VIII. A POSITA would have combined *Saxler, Yoshida*, *Beach*, and *Shenoy* (Ground 3)

A. The Petition provided a motivation to combine

Patent Owner's arguments against the motivation to combine *Saxler, Yoshida*, *Beach*, and *Shenoy* misapprehend the combination and the law. POR, 56-59.

The Petition explained a POSITA would have used the techniques of *Beach* and *Shenoy* to simplify *Saxler-Yoshida*'s process with "fewer masking steps" and to "improve alignment and symmetry between layers and reduce steps and costs." Petition, 60-63. The Petition reasoned the combination was a simple substitution of known elements predictably yielding *Saxler-Yoshida*'s structure. *Id.* Likewise, the Petition identified steps to create *Saxler-Yoshida*'s gate structure (Petition 60) and steps *Beach* and *Shenoy* would have used in replacement (Petition 61-63). Patent

Owner's contentions the Petition does not articulate a reason to combine "Saxler, Beach, and Shenoy" [6] and does not "give[] the specific process"[7] is also unfounded. POR, 56-57.

Patent Owner's analysis fundamentally misunderstands obviousness. Patent Owner argues "there would be no motivation to apply the 'self-aligned' technique of *Beach*" because "*Saxler* does not disclose any 'self-aligned' structures." POR, 58. But the opposite is true—a POSITA would have looked to *Beach* to simplify *Saxler*'s process by reducing steps and costs and to improve alignment. Petition, 60-63. Moreover, *KSR* expressly rejected Patent Owner's rigid "teaching, suggestion, motivation" approach. *KSR*, 550 U.S. at 418-19. Patent is further wrong because *Saxler* discloses self-aligned structures by incorporating *Smith*. Petition, 6-7; *Saxler*, [0087].

The Petition begins its motivation analysis by noting *Saxler*'s flexible approach, then identifies reasons to use *Beach* and *Shenoy*: to simplify "using fewer masking steps" and "improve alignment and symmetry between layers and reduce

[6] Patent Owner misidentifies the combination of Ground 3 by omitting *Yoshida*. POR, 56-57.

[7] Patent Owner cites an irrelevant discussion ("Pet. 34") that does not address Ground 3. POR, 57.

steps and costs." Petition, 60-63. The Petition thus does not engage in hindsight or rely solely on *Saxler*'s flexible approach to motivate the combination, as Patent Owner alleges. POR, 58-59.[8]

B. *Beach*'s self-aligned approach is compatible with *Saxler*

Ground 3 relies on *Beach* to disclose a self-aligned process that etches two layers with one mask. Petition, 57-63. It is irrelevant that *Beach* etches n-type materials when *Saxler* has p-type. POR, 50. *Beach*'s self-aligned method of making stacked structures in GaN HEMT devices using a single mask can be used in *Saxler* or *Yoshida*'s device. *Id.*, [0040], [0045], [0054]; Shealy, [152].

The combination would not "cut off" *Saxler-Yoshida*'s cap layer sidewalls. POR, 48-49. The combination uses *Saxler*'s etching technique to create sloped sidewalls when using *Beach*'s one-mask approach, which is like *Smith*'s approach (incorporated by reference). Petition, 57-63. The combination then uses *Shenoy*'s approach to undercut the photomask to achieve modified Figure 1A. *Id.*

[8] The Board should disregard Patent Owner's confusing argument "Shenoy cannot be implemented in the process of Saxler as modified by Beach without undue experimentation as discussed in §IV.D." POR, 68. No such analysis exists. The POR nowhere discusses "undue experimentation," and § IV relates to the Statement of Material Facts, not Ground 3. POR, 8.

C. *Shenoy* would not have etched "the underlying ledges" of the p-type GaN

Dr. Shealy explained *Shenoy* discloses symmetric, "isotropic etching through a photo resist window" because "symmetry is present in the [gate] structure," the same symmetry present in *Saxler-Yoshida*. Ex. 2004, 96:17-98:9. This symmetric undercut was typical of many wet etches, not just *Shenoy's* EMM (which would "work fine" for the combination). *Id.* at 96:17-98:9, 101:3-18; Petition, 6-8, 58, 63. Dr. Shealy explained this approach would etch the gate metal, not the p-type GaN layer, which was more resistant. *Id.*, 98:10-100:23.

Patent Owner's expert disagreed. POR, 50-55; Ex. 2005, ¶¶157-174. But Dr. Schubert bases his opinion on the unsubstantiated belief that the GaN layer etches at the same rate as the gate metal. Ex. 2005, ¶174 ("the etching process proceeds in all directions at the same rate absent an insulator.") And it is premised on the incorrect statement that *Saxler* does not disclose passivating GaN material. *Id.* at ¶170. In fact, *Saxler* repeatedly describes passivation techniques. *E.g.*, *Saxler*, title, [0023]-[0025], [0067]. Dr. Shealy explained why the p-GaN material etches more slower than the gate metal, resulting in *Saxler-Yoshida*'s gate structure. Ex. 2004, 96:17-101:18.

IX. *Yoshida* alone discloses horizontally extending sidewalls of the p-GaN layer of [1d] and [5g] (Ground 4)

The Petition showed *Yoshida* renders obvious [1d] and [5g] under Patent Owner's construction because a POSITA would have understood its vertical

sidewalls slope outwards when implemented in practice. Petition, 67-68. Patent Owner mischaracterizes the Petition as asserting an inherency argument under 35 U.SC. § 102, inappropriately relying on caselaw addressing anticipation. POR, 61-62 (citing *In re Robertson,* 169 F.3d 743, 745 (Fed. Cir. 1999); *Continental Can Co. USA, Inc. v. Monsanto Co*., 948 F.2d 1264, 1268 (Fed. Cir. 1991); *Rexnord Indus., LLC v. Kappos*, 705 F.3d 1347, 1355 (Fed. Cir. 2013)). Unlike anticipation, obviousness permits supplementing a missing limitation "generally known" in the art. *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1338-39 (Fed. Cir. 2020).

X. A POSITA would have modified *Yoshida* to incorporate *Saxler*'s sloped sidewalls (Grounds 5-6)

Patent Owner's arguments against incorporating *Saxler*'s sloped sidewalls into *Yoshida*'s cap layer rest on the flawed assumption the combination "widen[s] the pn-junction" and *Yoshida* teaches away from sloped sidewalls. POR, 64-65. This presumes sloped sidewalls ***extend*** existing sidewalls and overlooks the alternative—using *Saxler*'s etch (Petition, 70; Shealy, 187) within the p-GaN's existing footprint creates sloped sides and maintains the same (or less) width at the bottom of the p-GaN (Petition, 88-92). *Id.* Even if *Yoshida* teaches away from widening the pn-junction as Patent Owner alleges, *id.*, the combination does not require widening it. Regardless, the POR identifies no statement that rises to the level of a teaching away.

POR, 64-66; *UCB, Inc. v. Actavis Laby's UT, Inc.*, 65 F.4th 679, 692 (Fed. Cir. 2023).

XI. *Yoshida* in view of *Saxler*, *Beach*, and *Shenoy* render obvious claims 2 and 5-7 (Ground 6)

A. A POSITA would have formed the claimed "ledges" in *Yoshida-Saxler* using the combination of Ground 6

Using *Beach*'s and *Shenoy*'s techniques to form *Yoshida-Saxler*'s structure would have been a simple substitution that improved alignment and reduced steps. Petition, 88-92. Patent Owner alleges *Yoshida* is a gate-last approach, so the combination would have added steps. POR, 72. But the one-mask approach eliminates a masking step and permits etches gate and p-GaN in one step, using *Saxler*'s method to shape the sloped sidewalls, followed by an undercut. Petition, 69-71, 88-92. Further, *Yoshida* specifies no order of gate and ohmic contact formation (Yoshida, [0022]), and it teaches finishing the gate *before* the ohmic contacts. Ex. 2004, 76:1-80:16. A POSITA would have formed *Yoshida*'s gate "in any order" because a POSITA would have possessed ordinary creativity. Ex. 2004, 76:24-77:1; Shealy, [234]-[235]; *KSR*, 550 U.S. at 418, 422.

The POR argues *Shenoy*'s undercut decreases gate width, so it reduces voltage control. POR, 72. That runs contrary to *Yoshida*, which has a narrow gate and touts advantages of its voltage control. *Yoshida*, [0017], Fig. 1.

The combination would form the claimed ledges. Petition, 88-92, 107-108. Dr. Schubert's testimony to the contrary rests on the unsubstantiated belief *Yoshida*'s cap layer would etch at the same rate as the gate metal and *Saxler* does not disclose passivating the GaN material. POR, 72-73; *supra* §VIII.C. Dr. Shealy explained why the p-GaN material would etch slower than the gate metal, resulting in *Yoshida-Saxler*'s gate structure. Ex. 2004, 96:17-101:18.

Yoshida does not teach away from alternative fabrication methods, as Patent Owner asserts. POR, 73. *Yoshida*'s improvements arise from its structure, not its fabrication methods. *Yoshida*, [0009]. *Yoshida* never disparages "conventional photolithography and etching" so does not teach away. *Id*., [0006]; *UCB*, 65 F.4th at 692 (citing *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009)). Indeed, *Yoshida* uses the conventional methods it discussed. *Yoshida*, [0006], [0022].

B. A POSITA would have combined *Yoshida, Saxler*, *Beach*, and *Shenoy*

Patent Owner wrongly contends the Petition has "similar deficiencies" in motivating the Ground 6 combination as for Ground 3. POR, 74. But the Petition identifies processing steps *Yoshida* employs, steps to incorporate from *Saxler* to create sloped sidewalls, and replacement steps from *Beach* and *Shenoy*. Petition, 88-92. Further, the Petition articulated reasons a POSITA would have made the combination: to "improve[] efficiency by eliminating masking and etching steps and

[to] ensure[] symmetry of the gate metal with respect to the p-gate material." *Id.* at 89-90.

The POR cryptically suggests Ground 6 is improperly based on *Yoshida*'s Fig. 1 without explaining which limitations are allegedly not disclosed. POR, 74 (discussing *Hockerson*). Elsewhere, the POR contended Figure 1 cannot disclose the "substantially equal" requirement, but as shown above, that contention is incorrect. *Supra* §VI.

XII. Conclusion

For the foregoing reasons and as explained in the Petition, the Board should find all claims of the '335 patent unpatentable.

Dated: September 10, 2024

/Lionel M. Lavenue/
Lionel M. Lavenue
Reg. No. 46,859

37 C.F.R. § 42.24(D) CERTIFICATION

Pursuant to 37 C.F.R. § 42.24(a)(1)(i), Petitioners certify that this petition complies with the requirements of 37 C.F.R. § 42.24. Excluding parts of this Petition exempted under § 42.24(a), this Petition contains 5,583 words, as measured by the word-processing system used to prepare this paper.

Dated: September 10, 2024

By:/Lionel M. Lavenue/
Lionel M. Lavenue
Reg. No. 46,859

CERTIFICATE OF SERVICE

The undersigned certifies that a copy of this Petitioner's Reply to Patent Owner's Response and Exhibit 1032 were served on September 10, 2024, via email directed to counsel of record for the Patent Owner at the following:

Walter D. Davis, Jr.
walter.davis@blankrome.com

Dipu Doshi
dipu.doshi@blankrome.com

Mark F. Mashack
mark.mashack@blankrome.com

Stephen Soffen
stephen.soffen@blankrome.com

Cory R. Edwards
cory.edwards@blankrome.com

Ameya V. Paradkar
arun.paradkar@blankrome.com

Jonathan England
jonathan.england@blankrome.com

EPCC-Inno-IPRS@blankrome.com

Dated: September 10, 2024

By:/Daniel E. Doku/
Daniel E. Doku
Litigation Legal Assistant
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP