

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

Case IPR2023-01383
U.S. Patent No. 8,404,508

PATENT OWNER'S SUR-REPLY

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LISTING OF EXHIBITS

Exhibit 2001	Declaration of Dr. E. Fred Schubert
Exhibit 2002	Deposition Transcript of Dr. James Shealy, May 23, 2024
Exhibit 2003	Exhibit prepared by Dr. Shealy at Deposition
Exhibit 2004	U.S. Patent 6,478,871, filed Oct. 2, 2000
Exhibit 2005	U.S. Patent 9,991,360, filed Mar. 5, 2012
Exhibit 2006	U.S. Patent Application Publication 2008/0087915, filed Jul. 24, 2007
Exhibit 2007	U.S. Patent D715,107, filed Jul. 26, 2013
Exhibit 2008	Evidentiary Hearing Transcript, pages 239-506 (Inv. No. 337-TA-1366) (Public)

CLAIM LISTING¹

Element Designation	Claim Language
Claim 1	
[1pre]	A method of forming an enhancement mode GaN transistor, the method comprising:
[1a]	nucleating and growing transition layers on a substrate;
[1b]	growing an III Nitride EPI layer over the transistor layers;
[1c]	growing an III Nitride barrier layer over the EPI layer;
[1d]	growing a GaN layer with acceptor type dopants over the barrier layer;
[1e]	
[1e1]	depositing a gate contact layer on the doped GaN layer;
[1e2]	applying a gate photo resistant pattern;
[1e3]	etching away the gate contact layer outside the gate region;
[1e4]	etching away the doped GaN layer, except a portion of the doped GaN layer beneath the gate contact;
[1e5]	removing the gate photo resistant pattern;
[1f]	
[1f1]	depositing a dielectric layer;
[1f2]	applying a contact photo resistant pattern;
[1f3]	etching the dielectric layer to open the drain and source contact area;
[1f4]	removing the contact photo resistant patter;
[1g]	
[1g1]	depositing an Ohmic contact metal;
[1g2]	applying a metal photo resistant pattern;
[1g3]	etching the Ohmic contact metal;
[1g4]	removing the metal photo resistant pattern; and
[1g5]	performing rapid thermal annealing to form Ohmic drain and source contacts.
Claim 2	
[Claim 2]	wherein the EPI layer is comprised of InAlGaN.
Claim 3	

¹ Patent Owner utilizes the same designations as Innoscience for ease of reference.

[Claim 3]	wherein the barrier layer is comprised of InAlGa _N with a larger band gap than the buffer layer.
Claim 4	
[4pre]	A method of forming an enhancement mode GaN transistor, the method comprising:
[4a]	nucleating and growing transition layers on a substrate;
[4b]	growing an InAlGa _N EPI layer over the transistor layers;
[4c]	growing an InAlGa _N barrier layer over the InAlGa _N EPI layer;
[4d]	growing an InAlGa _N layer with acceptor type dopants over the InAlGa _N barrier layer;
[4e]	growing a GaN layer with acceptor type dopants over the doped InAlGa _N layer;
[4f]	
[4f1]	depositing a gate contact layer on the doped GaN layer;
[4f2]	applying a gate photo resistant pattern;
[4f3]	etching away the gate contact layer outside the gate region;
[4f4]	etching away the doped GaN layer and the doped InAlGa _N layer, except for portions of the doped GaN layer and the doped InAlGa _N layer beneath the gate contact;
[4f5]	removing the gate photo resistant pattern;
[4g]	
[4g1]	depositing a dielectric layer;
[4g2]	applying a contact photo resistant pattern;
[4g3]	etching the dielectric layer to open the drain and source contact area;
[4g4]	removing the contact photo resistant patter;
[4h]	
[4h1]	depositing an Ohmic contact metal;
[4h2]	applying a metal photo resistant pattern;
[4h3]	etching the Ohmic contact metal;
[4h4]	removing the metal photo resistant pattern; and
[4h5]	performing rapid thermal annealing to form Ohmic drain and source contacts.
Claim 5	
[5pre]	A method of forming an enhancement mode GaN transistor, the method comprising:
[5a]	nucleating and growing transition layers on a substrate;
[5b]	growing an InAlGa _N EPI layer over the transistor layers;
[5c]	growing an AlGa _N barrier layer over the InAlGa _N EPI layer;

[5d]	growing an AlGa _N layer with acceptor type dopants over the AlGa _N barrier layer;
[5e]	growing a Ga _N layer with acceptor type dopants over the doped AlGa _N layer;
[5f]	
[5f1]	depositing a gate contact layer on the doped Ga _N layer;
[5f2]	applying a gate photo resistant pattern;
[5f3]	etching away the gate contact layer outside the gate region;
[5f4]	etching away the doped Ga _N layer, except for portions of the doped Ga _N layer and the doped AlGa _N layer beneath gate contact;
[5f5]	removing the gate photo resistant pattern;
[5g]	
[5g1]	applying another photo resistant pattern;
[5g2]	etching the doped AlGa _N layer such that the doped AlGa _N extends outside the gate region towards the drain;
[5g3]	removing the photo resistant pattern;
[5h]	
[5h1]	depositing a dielectric layer;
[5h2]	applying a contact photo resistant pattern;
[5h3]	etching the dielectric layer to open the drain and source contact area;
[5h4]	removing the contact photo resistant pattern;
[5i]	
[5i1]	depositing an Ohmic contact metal;
[5i2]	applying a fourth photo resistant pattern;
[5i3]	etching the Ohmic contact metal;
[5i4]	removing the fourth photo resistant pattern; and
[5i5]	performing rapid thermal annealing to form Ohmic drain and source contacts.

I. INTRODUCTION

The overarching issue in this case is whether Petitioner (Innoscence (Zhuhai) Technology Company, Ltd. and Innoscence America, Inc.) provided motivation for why a POSITA would have performed the steps of claims 1-5. Petitioner improperly introduces new arguments in its Reply (Paper 18) (“Reply”), presenting for the first time a specific step-by-step process that allegedly invalidates the ’508 patent.

Petitioner divorces the claims from the specification to impermissibly broaden the claims. Thus, contrary to the specification, Petitioner argues that the claims require no order between the gate formation steps (e.g., [1e]) (“gate formation” or “**G**”), dielectric formation steps (e.g., [1f]) (“dielectric formation” or “**D**”), or ohmic contact formation steps (e.g., [1g]) (“ohmic contact formation” or “**O**”) (Reply, 12), although the Institution Decision (ID) found otherwise (Paper 11, 12-13 (**D** must be performed before **O**)). Petitioner’s overly expansive reading of the claims is untethered to the specification, or the claim language as would be understood by a POSITA. Indeed, Petitioner relies upon application of so-called **G (Gate)**, **D (Dielectric)**, and **O (Ohmic)** concepts to allege these process formation steps fit together—not tied to the claim language or the specification. But a correct reading of the claim language and the specification demonstrate the only correct reading of the claims in view of the specification and the “present invention”

requires the ordered process of **G-D-O**. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315-16 (Fed. Cir. 2005) (*en banc*); Patent Owner’s Response (“POR”) (Paper 17), 17-25.

The POR demonstrated that Petitioner’s case-in-chief was fatally flawed for failing to specify a combined process that allegedly rendered obvious the claims. At best, Petitioner makes arguments that each process step – taken by themselves and in isolation – were known. But this is not the test; instead, “[t]he claimed invention must be considered as a whole, and the question is whether there is something in the prior art as a whole to suggest the desirability, and thus obviousness, of making the combination.” *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed. Cir. 1984); *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 399 (200) (“the subject matter as a whole would have been obvious.”).

Recognizing its deficiency, Innoscience presents new combinations with new motivations to combine. Not only was Patent Owner prejudiced by this untimely disclosure, but the arguments only further show that the proposed combinations of prior art fail to render obvious the claims of the ’508 patent.

II. CLAIM CONSTRUCTION

The claim language and the specification together dictate that the formation elements must be formed in a specific order: **G** ([1e], [4f], [5f]), **D** ([1f], [4g],

[5g]), and **O** ([1g], [4h], [5i]). Petitioner does not respond to and therefore concedes at least an **O-G-D** process is not covered by the claims. POR, 24-25, EX2001, ¶¶ 94-97.

There can be no dispute that the '508 patent's specification only explicitly describes a **G-D-O** embodiment. It is also uncontested that only a **G-D-O** process can simultaneously pattern and etch a field plate at source potential together with ohmic contact metal. EX1001, 3:6-9; POR, 17-25.

A. The Specification is Consistent with the “Present Invention”

The clear language of the specification informs a POSITA that the “present invention” includes two method claim elements: (1) “*making*” a self-aligned gate structure (EX1001, 3:1-5); and (2) “*pattern[ing] and etch[ing]*” a field plate at source potential *together with drain and source ohmic contact metal* (*id.*, 3:6-9).

The word “[f]urthermore” in the same “present invention” paragraph demonstrates that the inventors included simultaneous patterning and etching capability in the claimed process of making a transistor with a self-aligned gate. *Id.*, 3:6-9. All claims include limitations beyond forming the gate structure and recite each step needed to perform both “present invention” elements. POR, 17-22; Limitations [1e]-[1g], [4f]-[4h], [5f]-[5i].

In arguing the presence of a field plate is “optional” based on the Abstract (Reply, 2), Petitioner ignores that the claims are processes. Thus, structures like

field plates can be optionally formed by the process, but the process steps are critical and must comply with the “present invention.” And, as a result, the ’508 patent discloses only a **G-D-O** process capable of simultaneously forming the field plate and ohmic contacts. POR, 17-25.

Exemplary limitations [1g2] and [1g3] explicitly recite all steps necessary for complying with the simultaneous field plate and ohmic contact patterning and etching depicted as being part of the “present invention.” EX1001, 3:6-9, 3:65-67, FIG. 3E; EX2002, 28:24-32:9 (all figures of the patent include a field plate at source potential); POR, 17-22. This demonstrates the specification is consistent with the claims requiring a process capable of simultaneously forming the field plate and ohmic contacts, which leaves optional the field plate.

Moreover, Petitioner’s claim differentiation analysis is misleading. It focuses on apparatus claims (Reply, 3-4) that were never considered by the USPTO. EX1002, 88-92, 94 (electing method claims).

B. Simultaneous Formation of the Field Plate at Source Potential and Ohmic Contacts Within the Claims Requires G-D-O Process

Petitioner argues that “forming a field plate does not require the gate structure to be formed before the ohmic source and drain contact.” Reply, 4. But this argument is irrelevant. The “present invention” requires simultaneous formation of the field plate at source potential with ohmic contacts, which is consistent with the plain language of the claims. EX1001, 3:6-9. Patent Owner’s

construction requiring a G-D-O process sequence is the only construction that remains true to the claim language and the specification. POR, 17-25. As explained below, Petitioner's hypothetical non-G-D-O processes fail to meet both the claim language and "present invention", and are inconsistent with a proper claim construction analysis. *Infra* §II.C.

The method claims describe a process to form a transistor. The field plate described in the '508 patent is connected to the source contact (20) and extends over the gate structure, as shown in each figure. EX1001, Figs. 2, 3E, 4, 5E, 6, 7F, 8, 9, 10, 11, 12; EX2002, 28:24-32:9. Generally a field plate can be formed after the ohmic contacts (Reply, 4), but that is not what this specification discloses as the "present invention" (simultaneous formation) (EX1001, 3:6-9) or claims (e.g., limitations [1g2]-[1g3]).

C. Petitioner's Hypothetical D-O-G and O-G-D Processes Ignore Claim Limitations and the Specification

Ignoring the claims and the specification, Petitioner provides generic examples of **D-O-G** and **O-G-D** processes attempting to extend the claims beyond the invention. Reply, 4-12. But this backfires by showing these sequences are not consistent with the claim language or the "present invention" (*supra* §I.A-B). Further, Petitioner identifies no basis in the specification that the claim language as written covers these processes.

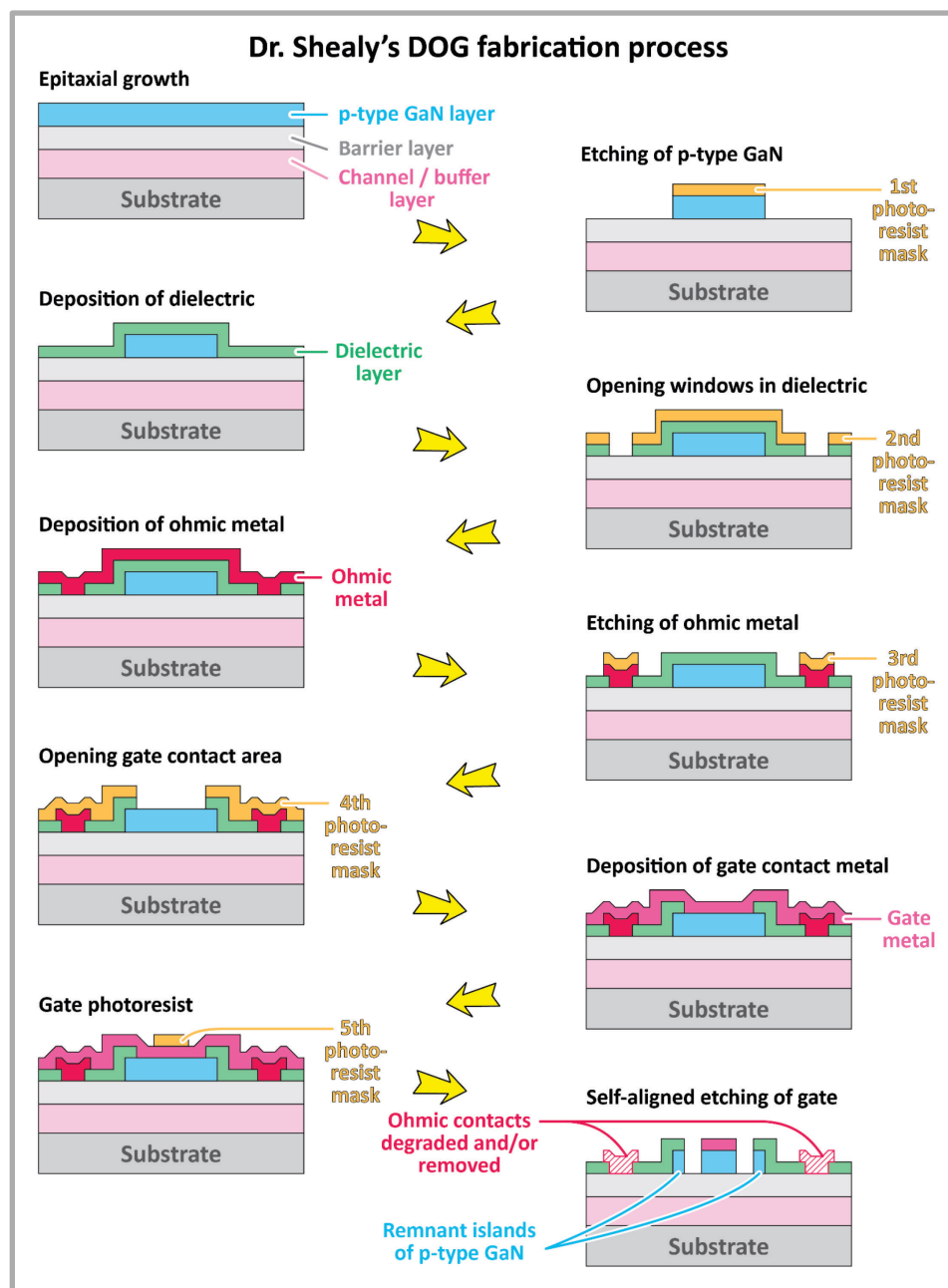
1. D-O-G Is Not Operable & Contradicts Claim Language

Petitioner presents two incomplete sequences (omitting steps) showing **D-O-G** sequences. Reply, 5-8. One process with remnant islands and one without. *Id.*, 5, 7. The present issue, however, is the construction of the claims of the '508 patent and not whether a hypothetical **D-O-G** sequence can be achieved. Because the incomplete sequences are not tethered to the claim limitations, they are irrelevant and do not show the claims cover a **D-O-G** sequence.

First, because the sequences show generic processes rather than addressing claim language, they should not be considered in claim construction. “[C]laim construction must begin with the words of the claims themselves.” *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 457 F.3d 1293, 1301 (Fed. Cir. 2006). The sequences omit claim limitations and elements within the limitations, and thus cannot be relied upon to establish **D-O-G** processes can practice every claimed element. For example, the claims require “[1e4] etching away the doped GaN layer, except a portion of the doped GaN layer beneath the gate contact,” and Petitioner fails to demonstrate how embodiments containing remnant islands meet that limitation.

The sequences conveniently omit certain etching steps to avoid conflicts with the claim language. However, based on Dr. Shealy’s described **D-O-G** process, a fuller sequence is shown below as previously explained by Dr. Schubert,

depicting the numerous additional photomasks, remnant islands, and degraded ohmic contacts. POR, 22-25; EX2001, ¶¶ 82-97.



As Dr. Schubert explained, and admitted by Petitioner, **D-O-G** processes leave detrimental remnant islands. *Id.*; Reply, 5. Whether remnant islands are beneficial is pure speculation as Petitioner failed to provide any analysis of the

modifications necessary to make such a configuration operable. Indeed, Petitioner chose not to reference prior art containing remnant islands, which proves this is solely unsupported speculation. *See cf.* POR, 22-25.

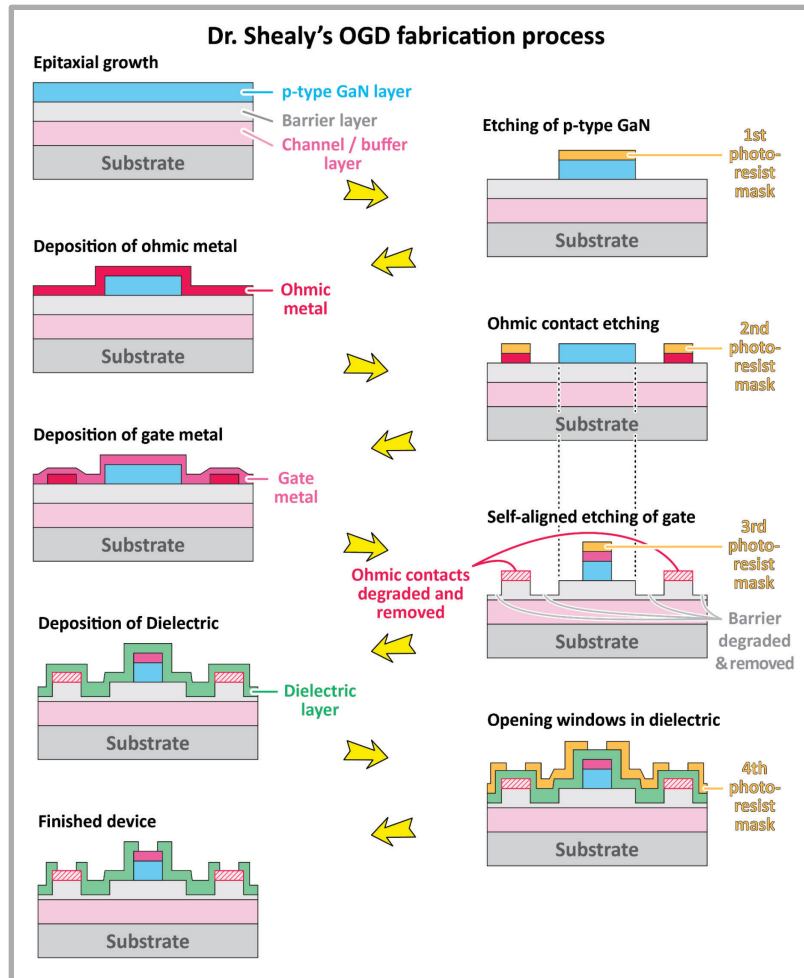
Petitioner also proposes an original sequence including additional processes removing the remnant islands. Reply, 7. But Petitioner also fails to show this sequence meets each claim limitation. Further, Petitioner only speculates without grounding its analysis in the specification that such **D-O-G** transistors formed without remnant islands remain operable while also forming (1) self-aligned gate structures and/or (2) field plates at source potential simultaneously with ohmic contacts. And because Petitioner does not adequately describe the sequences, tie the sequences to the specification and/or claim language, or account for the “present invention,” Petitioner cannot contravene Dr. Schubert’s testimony that an operative **D-O-G** process is not covered by of the claims.

2. O-D-G Processes are Not Within Claims

Assertions that **O-D-G** sequences are within the scope of the claims finds even less support in the claim language. This is evident by Petitioner failing to show the **O-D-G** sequences meets the claim elements. Reply, 8-12. Petitioner does not even address limitation “[1f3] etching the dielectric layer to open the drain and source contact area.” The specification and figures exclusively show opening the drain and source area for the dielectric material subsequent deposition and

formation of the ohmic contacts and fails to support Petitioner's implicit construction of the limitation. EX1001 3:57-67, Fig. 3D, FIG. 3E; *see also* Paper 11, 12-13 (**D** must be performed before **O**). Thus, Petitioner's proposed **O-D-G** sequence extends beyond the scope of what the inventors invented and cannot be the true construction. *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1305 (Fed. Cir. 2011).

Moreover, Petitioner's proposed **O-D-G** sequence omits numerous claim elements presenting a generalized sequence without identifying how each element is met. The sequence should accordingly be afforded little, if any, weight in evidencing whether **O-D-G** is within the scope of the claim language. Based on Dr. Shealy's testimony and Dr. Schubert's explanation, below is a more fulsome representation of Petitioner's described **O-D-G** to illustrate how additional steps would not meet the claim language, as Dr. Schubert explained. *See* Reply, 8-12; EX2001, ¶¶ 82-97.



As previously explained, etching gate metal in a **O-G-D** process degrades and removes portions of the ohmic metal in processes described by the claims of the '508 patent. POR, 24-25. Petitioner's new references are entirely untethered to the claim language of the '508 patent, and Petitioner relies upon generic **O-D-G** process elements instead of claim limitations. Reply, 10-11. Generic disconnected analysis is insufficient to rebut Dr. Schubert's analysis or justify broadening the claims beyond the invention. *Retractable Techs.*, 653 F.3d at 1305.

III. INNOSCIENCE’S NEW SEQUENCES AND MOTIVATIONS TO COMBINE ARE LATE AND SHOW THE PETITION FAILS ITS *PRIMA FACIE* BURDEN

Contrary to the directions of Consolidated Trial Practice Guide (2019) (“TPG”), Petitioner abandons its isolated limitation-by-limitation and reference-by-reference Petition invalidity analysis and now pivots to a sequence-based approach depicting modified combinations. Never having particularly explained the prior art combined process, Petitioner belatedly identifies new sequences and new motivations to arrive at those sequences.

There is no reason Petitioner could not have properly provided this analysis in the Petition. The new analysis does not respond to any arguments, but instead “gap-fills” the Petition’s deficiencies. This new analysis significantly prejudices Patent Owner’s ability to provide expert analysis. For example, it changes Petitioner’s invalidity theory (independent limitations-by-limitation analysis to modified combinations) and identifies new motivations to combine. The Board should not be forced to sift proper reply evidence and argument from improper reply evidence and should therefore “disregard arguments [and] late-filed evidence in its entirety.” TPG, 80.

A. Innoscience Belatedly Identifies Sequences and Combinations

Petitioner’s pivot clearly violates the TPG. “Petitioner may not submit new evidence or argument in reply *that it could have presented earlier, e.g., to make out a prima facie case of unpatentability.*” TPG, 73 (emphasis added). The new

sequences identifying modified prior art processes go beyond any TPG leeway: “[A] reply...that raises new issues or belatedly presents evidence may not be considered.” *Id.*, 74.

The Reply newly identifies process sequences and modifications of prior art that allegedly teach the claimed processes while the Petition previously only analyzed isolated individual limitations on a reference-by-reference basis—there was no process as a whole discussed. *Compare* Petition, 25-38, 51-60, 66-74, 78-89 (identifying isolated elements without combinations or overall process) with Reply, 13-33 (identifying sequence and showing combinations). The invalidity theory never addressed obviousness of the invention as a whole. *Lindemann Maschinenfabrik*, 730 F.2d at 1462 (“[t]he claimed invention must be considered as a whole, and the question is whether there is something in the prior art as a whole to suggest the desirability, and thus obviousness, of making the combination.”).

The new step-by-step combinations are plainly beyond the scope of a proper reply and prejudicial to Patent Owner, preventing Patent Owner from presenting responsive expert analysis. Additionally, Petitioner’s vague positions are being used as a sword and a shield. Petitioner initially obfuscated its theories and then pivoted and argued that Patent Owner addressed the wrong argument. Reply, 13-15 (“EPC does not properly address the Petition’s combination”), 26-27, 31. The

burden is on Petitioner to establish its invalidity case-in-chief in the Petition, not leave Patent Owner and the Board speculating at the combination of elements that render the invention as a whole obvious. TPG, 73; *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330-31 (Fed. Cir. 2019) (affirming Board’s finding that petitioner could not introduce new arguments on how to combine the prior art for the first time in the reply brief); *Dynaenergetics Eur. GmbH v. Swm Int’l, LLC*, No. IPR2022-01372, 2024 WL 422604, at *14 (P.T.A.B. Feb. 5, 2024) (excluding arguments presenting new ways to combine references and new motivation to combine support first identified in the reply brief).

The Reply sequences clearly constitute a new invalidity theory, including addressing the invention as a whole. *Lindemann Maschinenfabrik*, 730 F.2d at 1462. Each Ground in the Petition only presented a limitation-by-limitation analysis on a reference-by-reference basis, without addressing the invention as a whole. This change in tack is likely because the same analysis was explicitly rejected in the related ITC investigation cited by Petitioner (*see, e.g.*, EX1053).

Petitioner’s theory change is clear. For example, for claim elements [1e2] and [1g2], the Reply asserts that the “combination of *Yoshida-Beach* renders obvious separate steps of applying a gate photo resistant and metal photo resistant patterns at different times.” Reply, 25, 30, 33. This identification of separate steps was never presented in the Petition. *See, e.g.*, Petition, 30-33, 35-39, 56-58, 60-61,

71-74, 83, 89-90; *see also infra* §IV.E, §V.C (multiple process steps), §IV.A, §V.A (changing theory of Beach alone to Yoshida-Beach for limitation [1e4]). Similarly, the Reply sequences modify the theory that Beach discloses [1e4] to a combination of Beach and the Yoshida/Hikita347/Hikita023. *Infra* §IV.A, §V.A. These new theories and changing prior art demonstrate the sequence should have been presented in the Petition.

Petitioner only generally relies upon overinclusive citations to claim the theories were disclosed. Reply, 13 (“Pet. 18-24”), 15 (“Pet. 21-24”), 26-27, 31. But, as shown above, the theories have changed and the citations supporting the sequences are essentially entirely from re-direct testimony and supplemental declarations. *Id.* These new sequences are clearly a belated attempt to “gap-fill” Petitioner’s obviousness case-in-chief. TPG, 74.

B. The Reply Improperly Relies on New Motivations to Combine

The new sequences, including the **D-O-G** sequence relied upon in the Grounds, are further supported by new motivations to combine to achieve the sequences. As explained *supra* §III.A, this is prejudicial to Patent Owner.

The new motivations to combine improperly rely on new testimony from its expert. *Id.*, 17. For example, Petitioner newly argues “protect[ing] the gate region from contamination during subsequent processing steps,” motivates the combination of Yoshida-Beach to implement newly identified Figures (d) and (e),

but Petitioner never previously identified a sequence to the Yoshida-Beach combination or that it was a **D-O-G** process. Reply, 13. Additionally, new motivations based on the alleged conventional nature of self-aligned gate structures and transition layers are now relied upon to modify Yoshida. *Id.*, 14-15. Grounds 2 and 3 likewise include the same new arguments. *Id.*, 26-27 (Ground 2 - new motivation to combine to proposed Hikita347-Beach combination), 30 (Ground 2 - new motivation to combine Hikita347-Beach to perform separate steps of applying gate photo resistant pattern and metal photo resistant pattern), 31 (Ground 3), 33 (Ground 3).

These newly presented motivations to combine should have been included in the Petition. TPG, 74-75 (citing *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369-70 (Fed. Cir. 2016) (that “newly raised rationale to combine the prior art references that was not expressed in the petition” is an example of improper new reply evidence)).

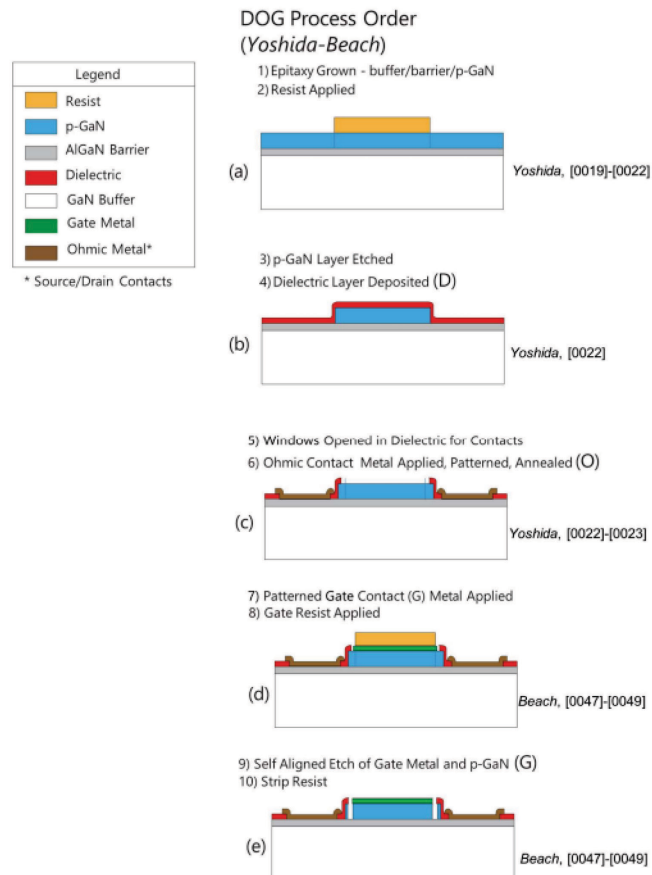
IV. GROUND 1: YOSHIDA-BEACH-SHEPPARD

Petitioner failed to establish a POSITA would find the claims as a whole obvious over Yoshida-Beach-Sheppard. The new sequence *admits* the proposed combination does not teach each limitation of Claim 1. Further, a POSITA would not have been motivated to modify Yoshida into a more complicated process.

Finally, even if combined, Petitioner cannot rebut that its analysis is based on hindsight.

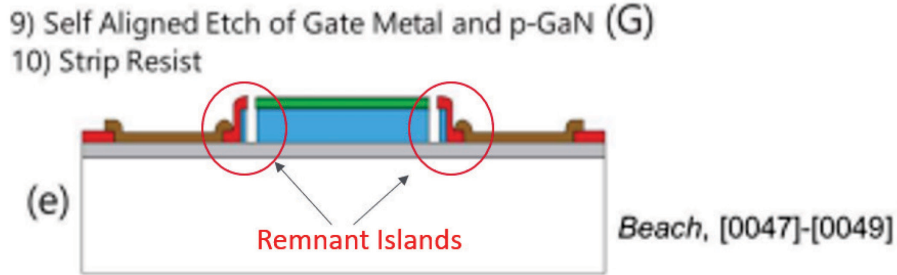
A. New Figures Show the Prior Art Does Not Teach Limitation [1e4]

Ground 1’s proposed combination fails to teach limitation [1e4] “etching away the doped GaN layer, except a portion of the doped GaN layer beneath the gate contact.” The newly provided “Modified Yoshida” sequence demonstrates this. Reply, 14 (annotated below).



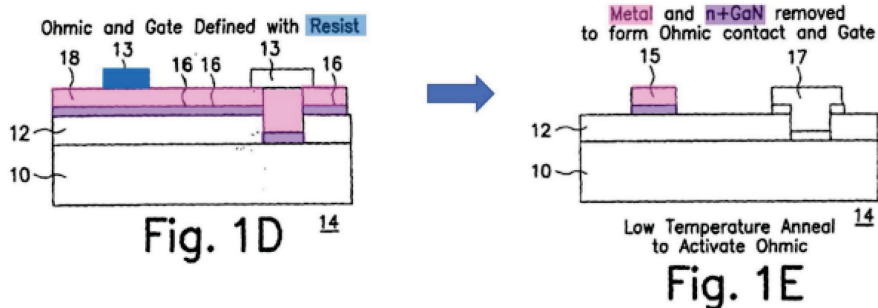
ShealySupp, ¶32 (Modified *Yoshida* process).

Reply, 14



Reply, 14 (annotated)

Modified Yoshida includes remnant islands, which are portions of the p-GaN material beyond the gate contact that remain after Petitioner's step corresponding to limitation [1e4]. Petitioner, however, never explains how this claim limitation is met by the combination. This differs from the Petition whereby Petitioner identified (figures below): "Beach discloses...step [1e4], i.e., etching away the doped GaN layer, except a portion of the doped GaN layer beneath the gate contact, as shown below." Petition, 33.

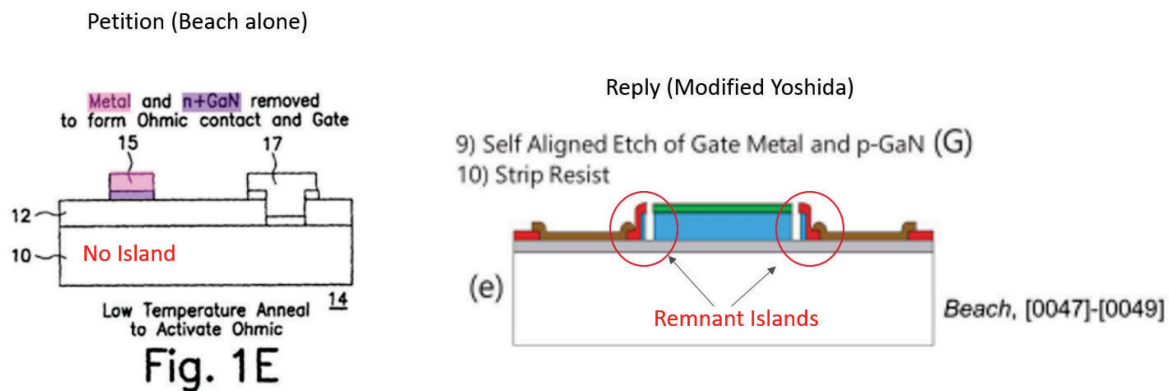


Beach, Figs. 1D, 1E.

Petition, 33

Petitioner's modified argument is evident from the Petition contesting that Beach alone teaches limitation [1e4] (no remnant islands in figures) to the Reply's

modified Yoshida (remnant islands). Either Petitioner changed its theory from Beach alone discloses element [1e4], as identified in the Petition, to modified Yoshida, as articulated in the Reply (and shown below). Or, Petitioner failed to explain how modified Yoshida with the “remnant islands” taught limitation [1e4] in the Petition.²



Limitation [1e4] Comparison. Petition, 33 (annotated); Reply, 14 (annotated).

B. Petitioner Fails to Show a Motivation to Combine

Petitioner has established no motivation to modify Yoshida into a more complicated process. POR, 34-47. Even correcting for the Petition’s vagueness, the POR illustrated the overall deficiencies in Petitioner’s initial analysis. *Id.* The new sequence and motivations to combine do not overcome the Petition’s deficiencies, absent hindsight.

² Petitioner accusation of improper bodily incorporation is a red herring. The Petition solely identified Beach as teaching [1e4]. Petition, 33.

1. New Sequence is Deficient

The claim that Patent Owner failed to address Petitioner's combination is misleading. Reply, 15. The POR addressed the explicit prior art combination stated in the Petition, including the relevant motivations to combine the prior art when considering the references as a whole. POR, 34-47. *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019) (motivation to combine analysis considers the prior art as a whole).

Additionally, Petitioner's claim that Patent Owner never addressed the combination is deceiving given Petitioner's initial invalidity theory. Petitioner presented isolated limitations on a reference-by-reference basis without particularly identifying the resulting combination. *See, e.g.*, Petition, 33 ("Beach discloses step [1e3]...and [1e4]....Fourth, Beach discloses step [1e5]"). Once Petitioner identified how each limitation was disclosed only then did the Petition generally state: "A POSITA would have been motivated to apply Beach's single mask process to form Yoshida's device..." *Id.*³ Thus, the POR addressed the arguments and demonstrated Petitioner's deficient Petition.

The isolated analysis, prior to the Reply, does not clarify the portion of Beach that is incorporated into Yoshida or the resulting modified process.

³ Petitioner makes similar assertions about Beach disclosing elements of the claims without reference to the resulting modified Yoshida concerning Beach's disclosure relating to elements [1g2-1g4]. Petition 35-37.

Regardless, the POR demonstrated the disparate references and lack of motivation to combine with an expectation of success. POR, 34-42. Thus, “gate-simultaneous” being distinct from “gate-last” is relevant to a POSITA combining the references.

Id.

Indeed, Petitioner conflates the gate-simultaneous motivation to combine analysis with the ’508 patent claiming a **G-D-O** gate-first process, as described above. *Supra* §II. And, as explained in the POR, the Petition failed to demonstrate the cited prior art—two gate-last references and a gate-simultaneous reference—renders obvious a gate-first process. POR, 36-41. None of the Reply’s analysis that it would have been obvious to modify Yoshida-Beach-Sheppard to obtain a “gate-first” process specifically addresses the differences between the prior art and a gate-first process. Reply, 16. Nothing motivates a POSITA to change from a gate-last process to a gate-first process based on the disclosure of the prior art, and the differences to modify each element of the gate formation, ohmic formation, and dielectric formation process to achieve are more than selecting a known option among a limited set. Reply, 16-17; POR, 34-41. Finally, nothing provides an expectation of success in such a major modification.

2. New Sequence Does Not Agree with Motivation to Combine

Modified Yoshida is distinct from the original invalidity theory and does not abide by the original motivation to combine. Petitioner’s own sequence shows the

use of multiple additional masks over the prior art to obtain the self-aligned gate structure, even though the Petition identified Beach's single mask process as an improvement to reduce number of masks. Petition, 21-22. Thus, Modified Yoshida expressly contradicts the originally identified motivation to combine.



Modified Yoshida (Reply, 14); D-O-G explained

As can be seen in Modified Yoshida, a first mask is used to etch the p-GaN material (a), a second mask is used to open the dielectric material (b)-(c), a third mask is used to deposit and etch the gate metal (d) (showing post-etching gate

metal), and a fourth mask is used to form a self-aligned structure. Petitioner's new sequence accordingly *adds* etching steps over Yoshida.⁴ *See also* POR, 34-42.

Petitioner proposed a "simpler" process for ohmic contact formation. Petition, 23-24. However, for the same reasons explained above, and *infra* §IV.D, the sequences are more complicated processes than those identified by Yoshida.

C. Hindsight is the Only Basis for Petitioner's Combination

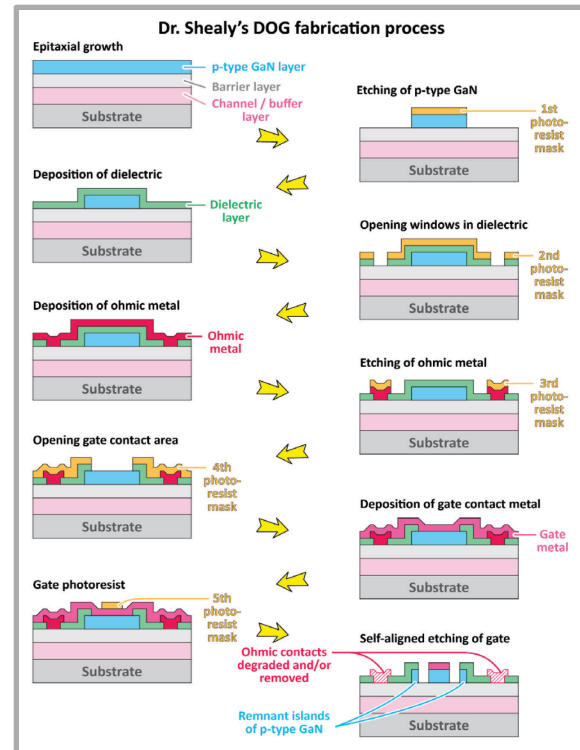
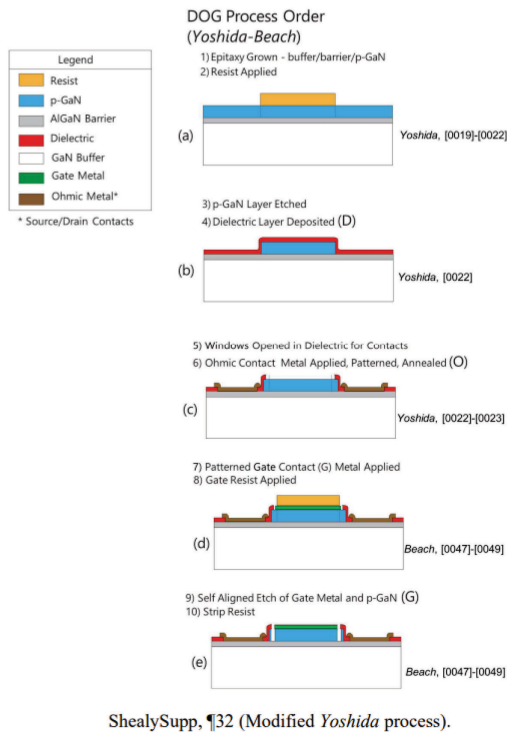
Ground 1 entirely relies upon hindsight recreation of the claimed invention. Patent Owner demonstrated that the differences in order, arrangement, method of operation, and materials would have precluded a POSITA from combining the references with an expectation of success absent hindsight. POR, 41-42.

The only alleged evidence supporting that the proposed combination is not hindsight is re-direct examination and Reply evidence. Reply, 17. But, Petitioner's argument generalizes the processes to avoid the intricate, and critical, differences in the prior art. For example, Petitioner generalizes the different transistor formation sequences involving **G**, **D**, and **O** formation steps. Not addressed is changing the order of the formation process also changes sub-steps within each formation step, as shown in Petitioner's **D-O-G** and **O-G-D** processes. Reply, 5, 9.

⁴ Petitioner's sequence already omits required photomasking steps.

Transistor fabrication processes involving different orders of **D**, **O**, and **G** formation steps were known. But different process sequences involve different steps in different orders, as shown by Petitioner's sequences. Reply, 5, 9. Petitioner provided no analysis tying the different process sequences to the claims at issue or the cited prior art and thus cannot rebut its hindsight analysis of the prior art. The claim that **D-O-G**, **O-D-G**, or **G-D-O** processes were known is true but irrelevant to the issues. Such general statements provide no motivation or expectation of success, given that they are divorced from the specific teachings of the prior art.

As explained *supra* §IV.B.2, the sequence involves numerous additional photomasking and etching steps than disclosed in the prior art references. Although Petitioner alleges simplification, as shown below, modifying the order of **G**, **D**, and **O** results in substantially more complicated processes.



Modified Yoshida (Reply, 14); D-O-G explained

Finally, attempting to map Yoshida-Beach—references with different sequences—onto the claims of the '508 patent only further demonstrates hindsight. Reply, 17. Neither the references nor a POSITA's knowledge suggests the sequenced combination—only the interrelated teachings of the '508 patent.

D. A POSITA Would Not Choose the More Complicated "O" Process

Yoshida describes a lift-off process. POR, 43-46. Petitioner's contention that Yoshida either does not disclose any ohmic contact formation process or an etching process is unfounded and premised entirely on speculation and non-analogous references. Reply, 18-24.

There is no dispute concerning the language of Yoshida. Reply, 18. Rather, Petitioner introduces unrelated references (Liang and Gorowitz) to interpret methods of formation and resulting structures. But, beyond confusing the issues, there is no evidence such teachings are relevant to Yoshida's or Beach's particular process. Instead, generalities of lift-off are discussed, but these arguments are strawmen of "typical[]" lift-off procedures that do not inform a POSITA of the relevant disclosures. *Id.*, 19-20.

Petitioner's new motivation for a POSITA to select an etching process of Beach because there are only two formation processes, is overly-generic and misleading. The Liang and Gorowitz references themselves demonstrate that even within lift-off there are a significant numbers of different processes. *Id.*, 19-23. By over-generalizing "lift-off" and "etching," Petitioner falsely narrows the choice to two broad categories. There are also numerous etching processes as demonstrated by '508 patent (one photo-mask vs. two-photo mask). POR, 8-16, 43; *supra* §IV.B.2. But as shown throughout this proceeding, modifying structure formation proceedings can result in more complicated and time consuming processes. *See, e.g.*, Reply, 14 (Modified Yoshida); *supra* §IV.B. (Modified Yoshida including additional photomasking etching processes).

Petitioner fails to address that a POSITA would not have been motivated to select the more complicated etching process described in Beach.⁵ POR, 43-47. There is no definitive tethering based upon a POSITA's knowledge of the processes disclosed in Yoshida. Instead, Petitioner only relies on the combined sequence resulting in additional masking steps. Moreover, it is undisputed that modified Yoshida necessitates additional masks to form the ohmic contacts through etching than a lift-off process. POR, 43-47. Finally, Petitioner fails to present any evidence that a POSITA would be motivated to select a more costly, time consuming process to obtain performance benefits in the process of modified Yoshida. Accordingly, speculative benefits cannot outweigh known detriments.

E. Petitioner Fails to Establish Yoshida-Beach Invalidates Both Applying [1e2] and [1g2] Steps

Maintaining the fallacy that the '508 patent recites apparatus claims, Petitioner continues asserting structures made by one process teaches *separate* process steps [1e2] and [1g2]. Reply, 24. This is wrong.

The Board preliminarily determined the separate steps can be performed simultaneously, but did not address whether they can be performed using a single process. Paper 11, 11-15. As explained in the POR, even though the result of a single process step is two elements (13), the prior art only teaches a single step—

⁵ It is unrefuted that Petitioner's own expert uses lift-off processes. POR, 47.

not two processes occurring simultaneously. POR, 48-53. Although two cookies are made using a cookie cutter, there is still only one step of applying the cookie cutter, not two simultaneous steps. *Id.*, 52-53.

Petitioner alleges the prior art combination suggests separate steps. Reply, 25. This is entirely based on hindsight, as previously noted. POR, 41-42, 48-53. Petitioner identifies no motivation to divide a single step into two steps except the hindsight splitting of Beach’s gate-simultaneous process. Further, splitting the step increases the number of photomasks, which would dissuade a POSITA. POR, 43-53 (additional photomask processes are disfavored).

V. GROUND 2 AND 3: HIKITA347/023-BEACH-SHEPPARD

Grounds 2 and 3 suffer the same deficiencies—and more—as Ground 1.⁶ *Supra* §IV. The POR clearly demonstrated Grounds 2 and 3 do not invalidate the claims. POR, 53-69. The new sequence fails to establish that the proposed combination, if made, teaches limitations [1e4], [4f4], or [5f4], a POSITA would modify the prior art to arrive at the claims as a whole, or Beach’s single step teaches two disparate claim limitations, or a “gate-first” process.

⁶ Grounds 2 and 3 are addressed together. The pertinent issues in the sur-reply apply equally to the proposed combination of Hikita347-Beach-Sheppard and Hikita023-Beach-Sheppard. Neither the difference in claims or prior art are material for the issues of the Sur-Reply.

**A. Petitioner Fails to Establish Hikita347/023-Beach-Sheppard
Render Obvious Claims 1-5 Consistent with Ground 1**

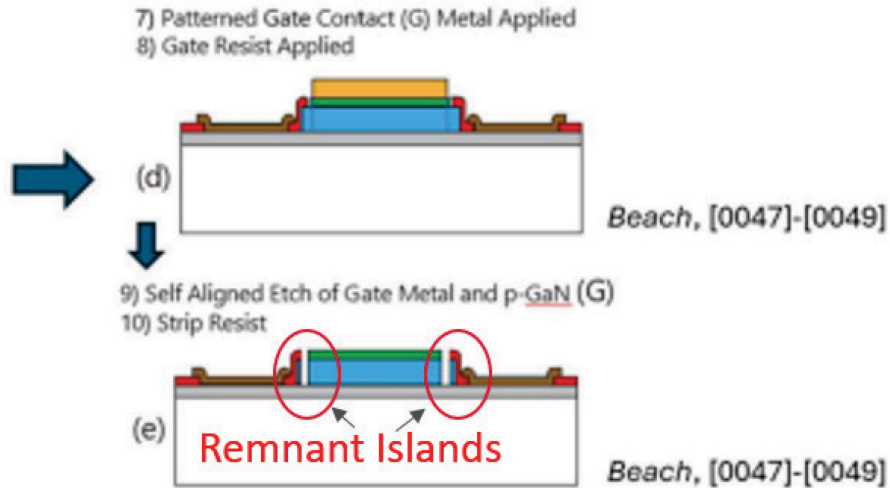
The cited art does not disclose a “gate-first” process meeting the limitations of claims 1-5. Should the PTAB adopt the proposed “gate-first” construction, Petitioner has failed to establish claims 1-5 are invalid under Grounds 2 and 3.

Even if Patent Owner’s construction is not adopted, the prior art does not teach each limitation of the claims or the invention as a whole, absent hindsight.

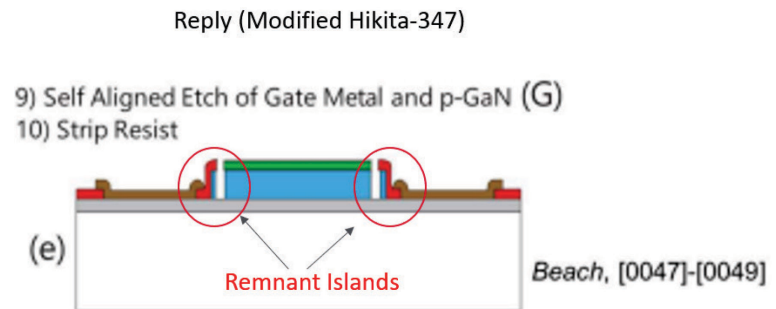
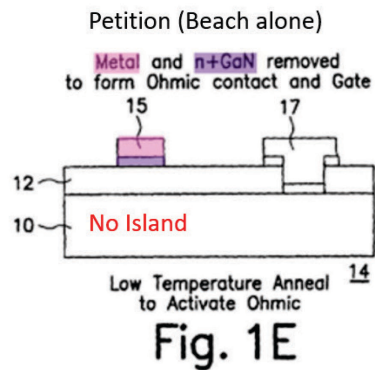
1. Petitioner Does Not Establish New Sequence Teaches Limitations [1e4], [4f4], [5f4]

Similar to Ground 1, the new sequence for Ground 2 (Reply, 27) fails to establish the proposed combination of Ground 2 discloses limitations [1e4], [4f4]. *Supra* §IV.A.⁷ As shown in Petitioner’s diagram (annotated and reproduced below), the combination results in remnant p-GaN islands. *Id.* Petitioner never identifies how remnant islands meets these claim limitations, and the Petition only identified figures without remnant islands. *Id.*

⁷ To the extent applicable, this analysis similarly applies to Ground 3 and limitation [5f4].



Reply, 27 (annotated)



Limitation [1e4], [4f4] Comparison (annotated). Petition, 33⁸; Reply, 27

2. No Motivation to Combine

The newly identified sequence is similarly deficient for the reasons explained above in Ground 1 and the POR. *Supra* §IV.B, §IV.D; POR, 53-69.

⁸ Petition cites to its Ground 1 analysis. Petition, 57-58, 70, 83.

Again, Petitioner misses the mark in arguing replacing a “gate-first” with a “gate-simultaneous” process is irrelevant. Reply, 27, 31. A POSITA would not have been motivated to modify Hikita347/023 with Beach based upon the differences in the prior art and the benefits disclosed by Beach. POR, 54-60, 63-66; *supra* §IV.B.1 (identifying same issues concerning Yoshida-Beach). Petitioner fails to address that the material differences in the references would dissuade a POSITA from incorporating all or any portion of gate-simultaneous teachings. POR, 54-55, 63-64.

Petitioner similarly misdirects the issues for ohmic formation of the Hikita347/023 versus generic etching and lift-off references. Reply, 28,31. These arguments are speculative and not tethered to any process relied upon in the Grounds—nor does Petitioner attempt to prove so. *Supra* §IV.B, §IV.D. Accordingly, Petitioner’s arguments are irrelevant for the reasons explained above. §IV.D. Regardless of Hikita347/023 disclosure, Petitioner does not rebut that a POSITA would have to select a more complicated etching process involving multiple photomasking steps, as shown by Petitioner’s sequence. *Id*; POR, 56-58, 64-65; Petition, 51, 78 (citing 23-24).

As explained above, Petitioner’s new combination is not consistent with its originally identified motivations to combine due to the inclusion of additional photomasking steps. *Supra* §IV.B.2. Therefore, for this additional reason, a

POSITA would not have been motivated to combine Hikita347/023-Beach-Sheppard to arrive at the presently claimed invention.

A POSITA would not have been combined Hikita347/023-Sheppard-Beach to achieve the claimed invention due to the dissimilarities between Hikita347/023 and Beach, requiring a more complicated process based solely on hindsight, and incompatibilities of the prior art references. POR, 54-60, 64-66.

B. Enhancement-Mode and Depletion-Mode Differences Matter

The conclusory claim that “ohmic contacts and gate processes are the same” for enhancement-mode and depletion-mode devices (Reply, 28-29, 32) is false given the functional differences in the gate materials, fabrication, and structure. POR, 58-59, 65. Even the prior art of record generally shows such differences. Petitioner fails to rebut that the differences in the devices would dissuade a POSITA from being motivated to incorporate one set of teachings into another. *Id.*; *supra* §V.A.2. Even if both references generically describe etching processes, that alone given the overall functional differences does not inform a POSITA to interchange fabrication techniques. *Id.*

Finally, even if Beach describes enhancement-mode as desirable, it is undisputed that Beach only teaches depletion mode devices. POR, 58-59, 65. A POSITA would recognize that if Beach’s teachings applied to enhancement-mode devices, Beach would have taught an enhancement-mode device since it allegedly

describes them as desirable. *Id.* Dr. Shealy's hindsight-based opinion is irrelevant for not being tied to any specific teaching in any reference. Reply, 29, 32.

C. Grounds 2 and 3 Do Not Teach Both Applying Photo Resist Steps Like Ground 1

Similar to Ground 1, Petitioner relies upon Beach as teaching limitations [1e2], [1g2], [4f2], [4h2], [5f2], and [5i2]. Petition, 57-58, 61, 71-72, 74, 89-90. Petitioner's argument is wrong because the claim limitations are distinct method steps, and for the remaining reasons expressed regarding Ground 1. *Supra* §IV.E.

VI. DR. SCHUBERT'S PRIOR APPROVAL

Petitioner objects to Dr. Schubert's expertise. Reply, 33-34. In the corresponding ITC dispute, Petitioner provided no objection to Dr. Schubert being certified as an expert for this precise subject matter. EX2008, 426:19-428:2.

VII. CONCLUSION

Petitioner failed to meet its burden, and claims 1-5 are not invalid.

Dated: October 16, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing PATENT OWNER'S SUR-
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Dated: October 16, 2024

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The undersigned certifies that a true and correct copy of the foregoing
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