

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HANWHA SOLUTIONS CORPORATION,
Petitioner

v.

MAXEON SOLAR PTE. LTD.,
Patent Owner

Case IPR2024-01199
U.S. Patent No. 8,878,053

PATENT OWNER SUR-REPLY

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PATENT OWNER’S EXHIBIT LIST

Exhibit No.	Description
2001	<i>Intentionally Left Blank</i>
2002	<i>Intentionally Left Blank</i>
2003	Gan, Jon-Yiew, Polysilicon emitters for silicon concentrator solar cells, Stanford University (July 1990) (“Gan Thesis”)
2004	<i>Intentionally Left Blank</i>
2005	<i>Intentionally Left Blank</i>
2006	Federal Court Management Statistics (June 30, 2024)
2007	<i>Intentionally Left Blank</i>
2008	<i>Intentionally Left Blank</i>
2009	Invalidity Contentions, <i>Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.</i> , Case No. 2:24-cv-00210-JRG (E.D. Tex. Sept. 6, 2024).
2010	Feldman, et al., “A Passivated Rear Contact for High-Efficiency n-Type Silicon Solar Cells Enabling High VocS and FF > 82%” (28th European PV Solar Energy Conference & Exhibition, Paris, Sept. 30 – Oct. 4, 2013) (“Feldman”)
2011	Chieh-Wa Tsai, et. al, <i>Patent Analysis of High Efficiency Tunneling Oxide Passivated Contact Solar Cells</i> , 13 <i>Energies</i> 3060 (2020)
2012	File History of U.S. Patent No. 8,222,516
2013	<i>Intentionally Left Blank</i>
2014	<i>Intentionally Left Blank</i>
2015	<i>Intentionally Left Blank</i>
2016	<i>Intentionally Left Blank</i>
2017	<i>Intentionally Left Blank</i>

Exhibit No.	Description
2018	<i>Intentionally Left Blank</i>
2019	U.S. Patent no. 8,222,516 to Cousins
2020	<i>Intentionally Left Blank</i>
2021	Docket Sheet, <i>Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.</i> , Case No. 2:24-cv-00210-JRG (E.D. Tex.)
2022	Docket Sheet, <i>Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp.</i> , Case No. 2:24-cv-00262-JRG (E.D. Tex.)
2023	Docket Sheet, <i>Maxeon Solar Pte. Ltd. v. REC Solar Holdings AS</i> , Case No. 2:24-cv-00260-JRG (E.D. Tex.)
2024	Counterclaims, <i>Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp.</i> , Case No. 2:24-cv-00262-JRG (E.D. Tex. Nov. 15, 2024)
2025	IPR2024-01040 Petition
2026	Declaration of Mary K. Bolin
2027	Declaration of Douglas Ruby, Ph.D.
2028	Curriculum Vitae of Douglas Ruby, Ph.D.
2029	Transcript of Deposition of Petitioner's Expert Zachary Holman, Ph.D. (May 8, 2025)

I. INTRODUCTION

Patent Owner submits its Sur-Reply to Petitioner's Reply (Paper 37, "Reply") to Patent Owner's Response (Paper 29, "POR").

II. PETITIONER'S REPLY IS REplete WITH MISCHARACTERIZATIONS AND DISTRACTIONS

Recognizing that it cannot succeed on the merits, Petitioner opens with a red herring—that Patent Owner's expert, Dr. Ruby, applied the wrong legal standard because he allegedly "believed the probability of success must be 'close to 100 percent.'" Reply, 3 (citing Ex. 1075, 165:17-166:8). This is not Dr. Ruby's testimony. Ex. 1075, 165:22-166:8. Rather, Dr. Ruby emphasized at least three times that he was not familiar with legal terminology and only provided his understanding of the term "reasonable expectation of success" in plain English, not in the legal context:

Q. Do you have an understanding of the legal standard required to demonstrate reasonable expectation of success?

A. Well, I know what reasonable expectation of success means in plain English.

Q. What is your understanding of the plain English meaning of "reasonable expectation of success"?

A. It means that the probability of success is close to 100 percent.
Ex. 1075, 165:22-166:1 (emphasis added).

Nor is Dr. Ruby's testimony at odds with the legal standard, *see, e.g.*, EX2027, ¶¶18-20 (describing the legal standard of obviousness applied in Patent

Owner's expert's declaration), which Petitioner cites as not requiring "[c]onclusive proof of efficacy" or "absolute predictability," Reply, 3. "[C]lose to 100 percent" is not requiring "conclusive proof" or "absolute predictability;" that would be 100 percent, not close to it.

Moreover, the Gan Thesis' documentation of Gan's failures of Gan and the Borden-575's documentation of the solar cell industry's general struggle with tunnel oxides undermines Petitioner's assertion for reasonable expectation of success. *Univ. of Strathclyde v. Clear-Vu Lighting LLC*, 17 F.4th 155, 164 (Fed. Cir. 2021) ("[T]here is also evidence showing that others had failed to inactivate MRSA. . . We have found that such failures undermine a finding of a reasonable expectation of success.") (emphasis added). The Gan Thesis evidences that, despite annealing at different temperatures and durations, Gan could not make a reliable tunnel oxide.

III. PETITIONER'S OBVIOUSNESS THEORIES ARE UNSOUND

Petitioner's obviousness theories rest on selective readings of the prior art and mischaracterizations of, or omissions in, the record. Each of Petitioner's proposed combinations fails to establish that a person of ordinary skill in the art ("POSITA") would have been motivated to make the combination with a reasonable expectation of success. As explained below, the cited references disclose inconsistent, unreliable, or narrowly applicable teachings that undercut

Petitioner's theories, while Petitioner repeatedly overlooks these shortcomings in favor of speculation and hindsight.

A. Petitioner's Theory Based on Froitzheim and Gan Is Unsound

The Gan Thesis undercuts Petitioner's obviousness theory based on Froitzheim and Gan. The Gan Thesis documents repeated failures and reliability concerns that would have discouraged a POSITA from modifying Froitzheim with Gan, and Petitioner's attempt to explain those failures and concerns away is futile.

Equally futile is Petitioner's contention that Gan's oxide layer was a "known" element based on references in related industries. The core dispute is whether a POSITA would have been able to implement such an oxide layer specifically in solar cells—something no prior art reference has shown to be achieved with enough reliability to lead to a reasonable expectation of success.

Petitioner also relies on expert statements that contradict facts. For example, the introductory paragraph under Section III of the Reply cites paragraph 20 of the declaration, which states "Dr. Ruby also does not dispute that a POSITA would have been motivated to combine the teachings of Froitzheim and Gan." Ex. 1077, ¶20 (citing Ex. 2027, ¶¶157-73). Paragraph 157 of Dr. Ruby's declaration in fact

states “[i]n my opinion, a POSITA would not have combined Froitzheim and Gan,” and paragraphs 158 to 173 explain why.¹

1. The Gan Thesis Would Have Discouraged a POSITA from Attempting Gan

Petitioner claims the Gan Thesis quotes lose force “when considered in context.” Reply, 7 (citing POR, 25). But none of the three contexts Petitioner cites overcomes the Gan Thesis’s record of repeated failure to reliably implement Gan’s polysilicon emitter and oxide layer structure. Thus, Petitioner fails to carry its burden of showing that POSITA would have been motivated to implement Gan in Froitzheim.

First, the Gan Thesis’s background on polysilicon emitters and interfacial oxides focuses on “silicon bipolar technology” (i.e., integrated circuits), *see, e.g.*, Ex. 2003, 24, not solar cells as Petitioner mischaracterizes, Reply, 7 (citing Ex. 2003, 10, 24-48). While this discussion may have sparked curiosity, it alone would not have motivated a POSITA seeking a reasonable expectation of success. *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Pat. Litig.*, 676 F.3d 1063, 1070 (Fed. Cir. 2012) (“While it may have been obvious to experiment with

¹ The fact that Dr. Ruby did not read the entire Gan Thesis is another red herring. Reply, 7, n. 3. The Gan Thesis is 120 pages long and much of it is not relevant to Dr. Ruby’s analysis.

the use of the same PK profile when contemplating an extended-release formulation, there is nothing to indicate that a skilled artisan would have had a reasonable expectation that such an experiment would succeed in being therapeutically effective.”); *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009) (citations omitted) (outlining “two classes of situations where ‘obvious to try’ is erroneously equated with obviousness under § 103,” one of which occurs “where what was ‘obvious to try’ was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.”).

In fact, the very pages Petitioner cites would have discouraged a POSITA from implementation. Ex. 2003, 24, 34, 46, 48 (repeatedly stating that the J_o of a polysilicon SIS emitter is too high for concentrator solar cells). Further, Petitioner has not shown that Gan’s J_o value would have been better than the J_o value achieved by Froitzheim’s own structure. Thus, Petitioner has not shown why a POSITA would have been motivated to look to Gan for improvement in the first place.

Second, the Gan Thesis may have achieved low J_o and ρ_c sporadically, but it was not able to achieve them consistently or even predictably. POR, 46-49. A POSITA would not have been motivated to discard the old and adopt the new if

they could not determine, from one cell to the next, the specific J_o values that would be achieved. Ex. 2027, ¶168. The Gan Thesis summarizes this in its “Conclusions” chapter, where it states on one hand that “polysilicon emitters with both low J_o and ρ_c can be obtained,” which is achieved by breaking the interfacial oxide “by only a very small fraction,” Ex. 2003, 118, but on the other hand that the oxide breakup “depends critically on the interfacial oxide thickness,” for which the “thin-oxide growth recipe used in this work was not reliable” and “a more reliable way of growing the thin oxide is needed,” *id.*, 119. Notably, the proposed Froitzheim-Gan combination would use “Gan’s fabrication of polysilicon emitter and oxide layer,” Petition, 24 (emphasis added)—the same fabrication method discussed in the Gan Thesis, *compare* Ex. 1005, 246 (12 steps for fabricating Gan’s test device, with “first-step anneal” appearing in step 4 and repeated in step 5 to indicate additional J_o measurements taken) *with* Ex. 2003, 92 (11 steps for fabrication the Gan Thesis’ test device, with “first-step anneal” only appearing in step 4); *compare* Ex. 1005, 246 (step 3 being “thin thermal oxide growth at 800 °C”) *with* Ex. 2003, 79 (documenting the procedure for preparing the thermally grown oxide, including step 7 being “[t]hermal oxidation 10 minutes at 800 °C,); *compare* Ex. 1005, 246 (Figure 1 illustrating Gan’s test device structure) *with* Ex. 2003, 93 (Figure 5.14 illustrating the Gan Thesis’ identical device structure). Thus, a POSITA would have known that, based on the Gan Thesis, Gan’s fabrication of

the oxide layer would not have been reliable. Ex. 1075, 60:21-61:4 (Patent Owner’s expert testifying that quality control was an important aspect of designing solar cells due to reproducibility—“you need to start with the same conditions in order to achieve the same results”).

Third, Petitioner mischaracterizes the Gan Thesis as “offer[ing] a solution,” Reply, 9 (citing Ex. 2003, 112), when the Gan Thesis merely considered an unproven assumption: “[I]t appears that the variation of the oxide thickness results mainly from the oxide-growth step. If this is the case, it is possible that the thin oxide growth can be improved by . . .” Ex. 2003, 112. Contrary to Petitioner’s assertion, this is speculation at best; the record makes clear that a reliable solution eluded Gan. In sum, the record fails to support a motivation to combine.

2. *A POSITA Would Not Have Known How to Implement Gan’s Structure in Froitzheim’s Solar Cell*

Petitioner’s focus on known elements (such as the knowledge of tunnel oxides in the transistor and semiconductor industries) highlights the weakness of its arguments on the feasibility of combining those known elements (such as a POSITA’s ability to combine the tunnel oxide with a polysilicon emitter in a solar cell). To that end, Petitioner’s mere suggestion that “a POSITA would have readily reconciled the teachings of Gan and Froitzheim regarding processing temperatures,” Reply, 4, or other missing components or variables for that matter, is not sufficient to show an expectation of success. *Grunenthal GMBH v. Alkem*

Lab'ys Ltd., 919 F.3d 1333, 1342 (Fed. Cir 2019) (Upholding ruling that prior art “provides insufficient guidance” and does not show an expectation of success where it instructs a POSITA to “vary temperature, concentration, agitation, pH.”); *Pfizer, Inc. v. Apotex Inc.*, 480 F.3d 1348, 1365 (Fed. Cir. 2007) (“To be sure, ‘to have a reasonable expectation of success, one must be motivated to do more than merely vary all parameters or try each of numerous possible choices. . .’”). Moreover, what works in one field of technology does not always work in another. *Nichia Corp. v. Everlight Americas, Inc.*, 855 F.3d 1328, 1337 (Fed. Cir. 2017) (affirming finding of no motivation to combine where claims were directed to making integrated circuit chips and the prior art references was directed to making LED electronics involving “substantial differences in the manufacturing processes and materials used in the different technologies.”). The Gan Thesis’ documentation of Gan’s failures and the Borden-575’s documentation of the solar cell industry’s general struggle with tunnel oxides undermine the motivation to make the specific combination of known elements Petitioner proposes. *Univ. of Strathclyde*, 17 F.4th at 164 (“[T]here is also evidence showing that others had failed to inactivate MRSA. . . We have found that such failures undermine a finding of a reasonable expectation of success.”) (emphasis added).

Petitioner’s misdirects should not divert the Board’s attention from Petitioner’s consistent failure to provide evidence showing that Gan’s interfacial

oxide could be reliably grown on the polysilicon emitter of the proposed Froitzheim-Gan solar cell. Petitioner again misrepresents Dr. Ruby's testimony as affirming that "POSITAs would have known how to implement oxide layers." Reply, 11 (citing Ex. 1075 107:12-108:5). To the contrary, when asked simply whether "by 2008 a person of ordinary skill in the art would have known how to add a tunnel oxide to a solar cell," Dr. Ruby testified that "it was a novel concept that was not generally known, discussed, or published. In fact, it was this Feldmann's publication in 2013 where it became more generally known." *Id.* at 200:10-201:1 *see also id.* at 67:19-68:9 (during his own extensive career in the solar industry, he never considered semiconductor or transistor technologies that were not already in solar cells).

Petitioner also misrepresents that Swanson's method of forming a tunnel oxide was instructive to a POSITA looking to combine Froitzheim and Gan. Swanson's tunnel oxide is formed using an "ozone oxidation process, which involves dipping wafer 102 in a bath comprising ozone suspended in deionized wafer" and where no heating is mentioned. Ex. 1015, 3:35-57 (cited in Reply, 11). In contrast, Gan's interfacial oxide is thermally grown at 800°C during a 10-minute oxygen flow. Ex. 1005, 246 (step 3). Further, Gan's interfacial oxide requires further annealing to achieve breakups *See, e.g.*, Ex. 1005, 249 ("When the interfacial oxide is intact, tunneling is the only process available for the majority

carries to pass through the interfacial oxide. This usually results in a high contact resistance because of low tunneling probability.”). Thus, a POSITA would not have been able to form Gan’s interfacial oxide layer on Froitzheim’s solar cell using Swanson’s method, nor would any generic knowledge of forming oxide layers in transistors or semiconductors have been sufficient to achieve an interfacial oxide layer like Gan’s (i.e., with a specific amount of breakup to control both J_o and ρ_c).

Another misdirection is Petitioner’s argument that the ’053 patent assumes a POSITA would have understood how to manufacture oxide layers. As the Board notes, obviousness involves a comparison between the challenged claims and the prior art. Paper 17 (Institution Decision), 7 (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007)) (“A claim is unpatentable as obvious, under 35 U.S.C. § 103, if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art.”) (emphasis added).

Petitioner points to no relevant case law stating otherwise. Reply, 12. Petitioner’s case, *Uber Technologies*, is distinguishable because the court found that a POSITA “was more than capable of selecting between the known methods” that were not related to the “alleged novelty of the [asserted patent].” *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1339 (Fed. Cir. 2020). In the present case, there

were no known methods for forming interfacial/tunnel oxide layers in solar cells.

In fact, the author of Gan admits that he could not consistently form such a functional oxide layer. Petitioner's other case, *Hesai Technologies*, cites *Uber* and is distinguishable for the same reason. *Hesai Tech. Co., v. Ouster, Inc.*, IPR2023-01421, Paper 45, 34-35 n.6 (P.T.A.B. Mar. 13, 2025).

Nor is it the case (or of any relevance) that the prior art disclosures are held to a higher standard than the challenged patent's disclosure. Petitioner seeks to distract the Board from the actual dispute between the parties—whether a POSITA would have been motivated to implement Gan's unreliable polysilicon emitter and oxide layer in Froitzheim's solar cell. With the presumed knowledge of the Gan Thesis, the answer is no.

3. *A POSITA Would Not Have Been Able to Implement Gan without Undue Experimentation*

Examination of the *Wands* factors in this case undermines the Petitioner's assertion of reasonable expectation of success by showing that others have failed. *Univ. of Strathclyde*, 17 F.4th at 164.

The record of this case is replete with evidence of prior failures—not just failures of others, but the failure of the author of the Gan reference—the critical prior art reference Petitioner relies upon. Several *Wands* factors show these failures. For example, there is no prior art showing successful formation of a tunnel oxide layer in a solar cell, but there is prior art that consistently shows

previous failures. POR, 35 (discussing *Wands* factor 5, state of the prior art). The amount of direction or guidance presented (*Wands* factor 2), absence of working examples (*Wands* factor 3), and the unpredictability of the art (*Wands* factor 7) also point in the direction of the failure of others. *Id.* Finally, the relative skill in the art (*Wands* factor 7) shows that a Ph.D. from Stanford, who far exceeds a POSITA's qualification, could not get the tunnel oxide layer in a solar cell successfully or consistently. *Id.* at 35-36.

4. *Claim 9 Does Not Encompass Claim 16's Additional Step of Forming an Oxide Layer*

Petitioner asserts that by using the transitional term “comprising,” claim 9 necessarily encompass claim 16's additional step of “forming an oxide layer.” Reply, 16-17. This defies both logic and legal principles.

Logically, while additional elements or steps are not excluded from claim scope when the term “comprising” is present, it does not follow that the claim requires those elements or steps. MPEP §2111.03 (“The determination of what is or is not excluded by a transitional phrase must be made on a case-by-case basis in light of the facts of each case.”).

Legally, bedrock case law rejects Petitioner's proposition that an additional step recited in independent claim 16 but not in independent claim 9 should nevertheless be included as a limitation to claim 9. *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1326 (Fed. Cir. 2003) (“[W]hen a patent claim ‘does

not contain a certain limitation and another claim does, that limitation cannot be read into the former claim in determining either validity or infringement.”); *Env’t Designs, Ltd. v. Union Oil Co. of California*, 713 F.2d 693, 699 (Fed. Cir. 1983) (citation omitted) (“It is improper for courts to read into an independent claim a limitation explicitly set forth in another claim.”); *U.S. Automobile v. PNC Bank*, IPR2021-01248, Paper 27, 23 (PTAB Jan. 3, 2023) (“It is well-settled that ‘extraneous’ limitations should not be read into a claim.”).

B. Petitioner’s Theory Based on Froitzheim, Gan, and Smith Is Unsound

As argued in sections III.A.1-III.A.2, a POSITA would not have had a reasonable expectation of success in modifying Froitzheim with Gan’s polysilicon emitter and interfacial oxide. The addition of Smith does not cure the deficiencies of the proposed Froitzheim-Gan combination because Smith does not disclose a polysilicon emitter or an interfacial oxide, and Petitioner does not contend otherwise. Consequently, Petitioner’s obviousness theory based on Froitzheim, Gan, and Smith fails at least for the reasons that the Froitzheim/Gan Ground fails..

Further, a POSITA would not have considered applying Smith’s techniques to Froitzheim and Gan because the benefit of those techniques is expressly directed to back contact solar cells. Froitzheim-Gan structure is not a back contact solar cell, and again Petitioner does not contend otherwise. Petitioner also introduces a

new argument that claims 2-4 and 11-13 of the '053 patent recite “routine”

manufacturing steps. This argument is improper and should not be considered.

1. Smith Limits the Benefit of its APCVD Technique to Back Contact Solar Cells

Petitioner’s strawman argument that Smith’s atmospheric pressure chemical vapor deposition process (APCVD) technique should not be limited to back contact solar cells is not relevant to the parties’ dispute. Reply, 19-22. What is relevant, and what Petitioner avoids addressing in its Reply, is that Smith limited the benefit of its APCVD technique to back contact solar cells.

Petitioner’s motivation to employ Smith’s APCVD technique rests on this benefit. Petition, 54 (citations omitted) (“For instance, Smith teaches that dopants can be deposited on the substrate using ‘APCVD.’ . . . Smith teaches that these steps ‘advantageously allow [] for one-sided deposition,’ which is ‘particularly useful in the manufacture of back side contact solar cells where only one side of the solar cell is textured.’”). Even in its own quote, Petitioner acknowledges that Smith’s APCVD and Smith’s one-sided deposition are “particularly useful in the manufacture of back side contact solar cells.” Thus, Smith may have motivated a POSITA to employ its technique to back side contact solar cells, but not to other types of solar cells such as described in Froitzheim. Petitioner avoids bridging this gap by arguing, instead, that Smith’s APCVD could have been applied to other types of solar cells. But that argument fails to address why a POSITA would have

been motivated to do so in the first place. After all, the obviousness test requires a showing of motivation to combine, and not just the possibility to combine.

2. *A POSITA Would Not Have Employed Smith's APCVD Technique and Thus, Also Would Not Have Employed the Accompanying In-Situ Steps*

Petitioner admits that, in the proposed Froitzheim-Gan-Smith combination, Smith's in-situ steps would be employed in conjunction with Smiths' APCVD technique. Reply, 23. Further, Petitioner does not dispute that if a POSITA would not have been motivated to employ Smith's APCVD technique, then a POSITA would also not have been motivated to employ Smith's in-situ steps. For the reasons stated in section III.B.2, *infra*., a POSITA would not have been motivated to employ Smith's APCVD technique. Thus, a POSITA would also not have been motivated to employ Smith's in-situ steps.

3. *Petitioner's Argument that Claims 2-4 and 11-13 Recite Routine Manufacturing Steps Is New and Impermissible*

In its Reply, Petitioner raises for the first time that "claims 2-4 and 11-13 recite routine manufacturing steps." Reply, 26. Being absent from the Petition, this argument is waived and should not be considered. *Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1002 (Fed. Cir. 2023) (quotations omitted) ("[T]he Board is not permitted to entertain '[s]hifting arguments' but must, instead, reject any 'entirely new theory of prima facie obviousness absent from the petition,' if the petitioner attempts to inject such a theory into the proceeding post-petition.");

Masimo Corp. v. Apple Inc., IPR2023-00745, Paper 44, 40 (PTAB Oct. 15, 2024)

(Determining the petitioner’s argument as “waived because it presents an entirely new theory that does not clarify an earlier position, is not responsive to arguments presented in the Patent Owner’s Response, and it raises entirely new issues and evidence.”).

Petitioner’s two fallback arguments are equally unavailing. First, Petitioner claims to have established a motivation to use Smith’s own dopant layers “because the Petition explains a POSITA would have been motivated to apply Smith’s APCVD teachings to manufacture the combination of Froitzheim and Gan.”

Reply, 26. This is inconsistent with Petitioner’s expert’s statements that a POSITA would have applied Smith’s teachings “to Froitzheim and Gan’s manufacturing processes”—not to replace those processes. Ex. 1003, ¶204; *see also id.* at ¶205.

Neither Petitioner nor its expert proposed replacing Froitzheim’s dopant source with the different dopant source used in Smith’s APCVD technique, let alone establish a motivation for doing so.

Second, Petitioner claims to have established “that a POSITA would have been motivated to apply Smith’s well-known manufacturing techniques, which includes texturing, to the combination of Froitzheim and Gan.” Reply, 26 (citing Petition, 54-56). This is inconsistent with the content of the cited pages, where “well-known” manufacturing techniques are only mentioned in the context of

arguing that Froitzheim, Gan, and Smith are analogous art. Petition, 56. But these pages do not propose applying “Smith’s well-known manufacturing techniques,” generally, or the motivation for them. Rather, they discuss specific Smith techniques such as APCVD and in-situ.

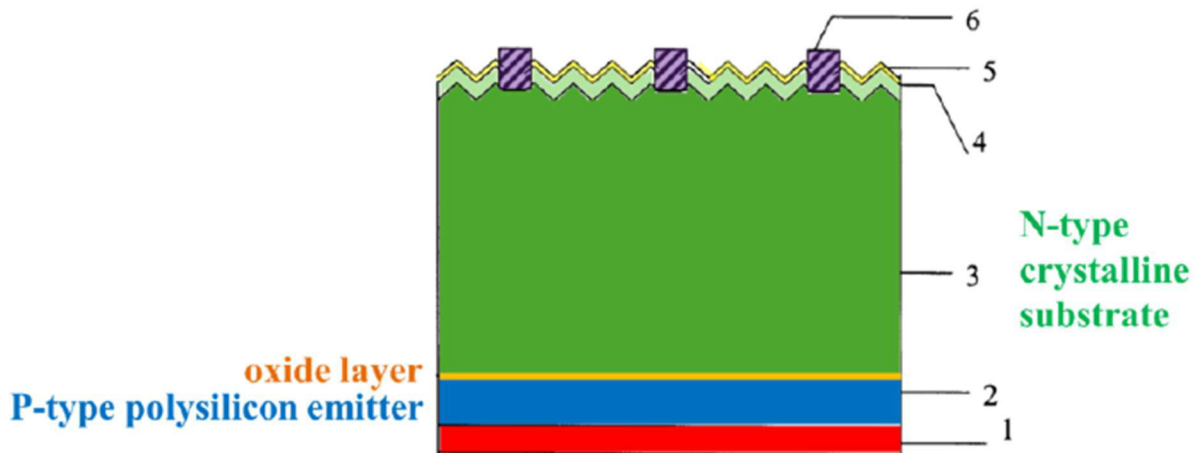
C. Petitioner’s Theory Based on Li, Gan, and Smith Is Unsound

Petitioner’s obviousness theory based on Li, Gan, and Smith also fails. As argued in sections III.A.1-III.A.2, Petitioner has not shown that a POSITA would have been motivated to combine Froitzheim with Gan. For the same and additional reasons, a POSITA would not have been motivated to combine Li with Gan. Further, Petitioner’s efforts to recast Li’s express criticism of high-temperature diffusion as a mere preference is inconsistent with both Li’s disclosure and the legal principles of teaching away.

1. Li’s Low Temperature Diffusion Is Not a Preferred Embodiment; It Is Li’s Only Embodiment

Li directly contradicts Petitioner’s argument that it merely prefers low-temperature diffusion but permits high-temperature diffusion. Reply, 27-28. Petitioner cites no support that Li permits or contemplates high-temperature diffusion at any point, other than Petitioner’s expert noting that Li permits “any deposition method,” Ex. 1077, ¶61 (citing Ex. 1008, 4). Deposition methods are not relevant to the parties’ dispute, which is over deposition temperature.

Equally irrelevant are the additional references Petitioner's expert cites to claim that Li's "phosphorus diffusion step requires higher temperatures." *Id.* at ¶66 (citations omitted). The parties' dispute is over boron diffusion, not phosphorus diffusion. According to Li, "a PN junction is prepared by a low-temperature method, which avoids a conventional diffusion process at 800-1000°C." Ex. 1008, 4 (emphasis added). As shown below, the proposed Li-Gan-Smith combination would include Li's N-type substrate and a P-type polysilicon emitter.



Petition, 77 (citations omitted) (annotated in Petition).

In the proposed combination, Gan's polysilicon emitter would be diffused with boron, not phosphorus. *Compare* Ex. 1003, ¶51 (citation omitted) ("It was well known prior to 2008 that boron was commonly used as a dopant to create p-type regions or layers.") *with id.* at ¶49 (citations omitted) ("It was well known prior to 2008 that phosphorus was commonly used as a dopant to create n-type

regions or layers.”). Thus, Petitioner’s expert’s argument on phosphorus diffusion is not relevant to the parties’ dispute.

In contrast, Patent Owner’s argument that low-temperature diffusion is Li’s requirement (not preference) is rooted in Li’s specification and is relevant to the parties’ dispute. Li’s specification begins with a description of crystalline silicon solar cell structures and its shortcomings, the first one being “such cells have the disadvantages that the high-temperature diffusion may cause more defects in silicon materials.” Ex. 1008, 3. This shortcoming leads to many problems (defects in silicon materials, pollution caused in high-temperature process, reduced cell efficiency) and forces complicated solutions (high requirements for materials and production environment). *Id.*

Li’s solution is the “[a]doption of amorphous silicon emitting region,” which not only has a “good surface passivation effect,” but also requires a low deposition temperature and simple deposition process “such that a high-temperature process is avoided, and the manufacturing cost of the cell is reduced.” Ex. 1008, 3. The amorphous silicon emitting region in Li’s cell structure is not a preferred embodiment, it is part of Li’s novelty:

In view of the problems of the conventional homojunction cells [high temperature diffusion] and the HIT cells [where the emitter is on the front surface], the present invention provides a novel cell structure: a crystalline silicon solar cell adopting an emitting region on a back

surface of thin film silicon. The solar cell adopts an amorphous silicon (which can also be microcrystalline silicon or nano-silicon) heterojunction emitting region and deposits the emitting region on a back surface of a silicon wafer.

Ex. 1008, 3 (emphasis added).

Because the amorphous silicon emitting region is part of Li's novel structure, high temperature diffusion would not be permitted. This is not only because Li expressly criticized higher temperature diffusion, but also because Li expressly stated that amorphous silicon uses low deposition temperature (200°C).

Ex. 1008, 3. And although Li contemplates use of microcrystalline silicon or nano-silicon instead of amorphous silicon, Li reiterates again in its "Detailed Description of Embodiments" section that "a PN junction is prepared by a low-temperature deposition method, which avoids a conventional diffusion process at 800-1000°C."

Ex. 1008, 4. If Li's strong criticism of high-temperature diffusion is reduced to a mere preference to avoid, then specifications lose meaning and purpose. *In re Urbanski*, 809 F.3d 1237, 1244 (Fed. Cir. 2016) ("A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.").

Lastly, even if Li merely expressed a preference (it does not), that preference would have, at a minimum, discouraged a POSITA from combining it with Gan

and its high temperature drive-in (diffusion). *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1069 (Fed. Cir. 2018) (“[E]ven if a reference is not found to teach away, its statements regarding preferences are relevant to a finding regarding whether a skilled artisan would be motivated to combine that reference with another reference.”).

2. *Li Teaches Low Temperature Diffusion and Discourages High Temperature Diffusion*

On one hand, Petitioner does not dispute the applicability of Patent Owner’s case *In re Urbanski*, in which the Federal Circuit held the definition of teaching away to be broader than what Petitioner asserts: “A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.” 809 F.3d 1237, 1244 (Fed. Cir. 2016) (quotation omitted). On the other hand, Petitioner seeks to impose a narrower standard for teaching away—that a reference may only teach away “when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant’s invention.” Reply, 27 (quoting *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005)).

The outcome, no matter which case is applied, is the same. Even *Syntex* agrees that a statement constitutes teaching away if it conveys “clear discouragement of that combination.” Reply, 27 (quoting *Syntex*) (“[a] statement

that particular combination is not a preferred embodiment does not teach away absent clear discouragement of that combination.”) (emphasis added). As discussed in section III.C.1 above, that is precisely what Li teaches—clear discouragement of using high temperature diffusion in its invention.

Thus, Li’s low temperature diffusion (200°C) and Li’s criticism of higher temperature diffusion (800-1000°C) would have discouraged a POSITA from replacing Li’s components with Gan’s polysilicon emitter and tunnel oxide, which require multiple rounds of high temperature processing, including diffusion at 900-1000°C. POR, 52-53 (citing Ex. 1005, 246 (steps 3, 4, 10); Ex. 2029, 216:16-217:7 (Petitioner’s expert testifying that the proposed Li-Gan-Smith combination would implement steps 3, 4, 9, and 10 from Gan). This is teaching away under *Urbanski*, and this is “clear discouragement” and therefore also teaching away under *Syntex*.

Lastly, because Li teaches away from Gan’s high temperature diffusion, Petitioner’s argument that Li’s lower temperature is a mere “trade off” consideration in cell design is irrelevant. *See, e.g., Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349–50 (Fed. Cir. 2000) (First examining a “trade-off” argument and holding that “[t]rade-offs often concern what is feasible, not what is, on balance, desirable. Motivation to combine requires the latter,” then holding that teaching away trumps the trade-off argument because “if [prior art reference] Johnson did in fact teach away from [prior art reference] Moore, then that finding

alone can defeat [defendant's] obviousness claim.”); *Polaris Indus.*, 882 F.3d at 1067-70, 1069 n.4 (citations omitted) (vacating and remanding the Board’s obviousness finding where the Board “failed to consider that ‘[m]erely stating that a particular placement of an element is a design choice does not make it obvious’” and mandating Board perform a teaching away analysis on remand to determine whether a reference’s “stated desire for a low center of gravity” “criticize[d], discredit[ed], or otherwise discourage[d]” the proposed modification.”) (first alteration in original).

IV. CONCLUSION

For the foregoing reasons and those in the Patent Owner’s Response, claims 1-20 in the ’053 patent are patentable.

Respectfully submitted,

Date: September 25, 2025

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Patent Owner Sur-Reply, exclusive of the table of contents, table of authorities, certificate of service, certificate of word count, and list of exhibits, includes 5,186 words. Pursuant to 37 C.F.R. § 42.24(d), Patent Owner relied on the word count feature of the word-processing system used to prepare this paper.

Dated: September 25, 2025

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CERTIFICATE OF SERVICE

I certify that the Patent Owner Sur-Reply was served on Petitioner's counsel
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