

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 No. IPR2024-01203

U.S. Patent No. 8,222,516

PETITIONER'S REPLY

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I. INTRODUCTION

Maxeon's Patent Owner Response ("POR") and the testimony of its expert Dr. Ruby confirm that the challenged claims are unpatentable. Dr. Ruby describes the challenged claims as "quite general" (Ex.1075-Ruby-Tr., 160:19-162:8), and Maxeon and Dr. Ruby admit that every feature of the challenged claims was known by the priority date. Outside of one dependent claim, they also admit that the Petition's combinations disclose each limitation, and they advance no secondary considerations to rebut obviousness.

Maxeon's challenge to motivation to combine and reasonable expectation of success turns on Dr. Ruby's opinions, but he admitted when deposed that he was unaware of the legal standards he was required to apply and the standard he did apply for reasonable expectation of success—that the probability of success must be "close to 100%"—is flat wrong. His opinions—and Maxeon's arguments relying on them—against motivation to combine and reasonable expectation of success should receive no weight.

Even apart from Dr. Ruby's fatal methodological error, Maxeon's arguments should be rejected for multiple other independent reasons. ***First***, Maxeon's arguments against motivation to combine and reasonable expectation of success fail to consider Petitioner's references for all they teach, and mischaracterize a reference

outside the claimed combinations, the Gan Thesis. Dr. Ruby admits he did not fully review the Gan Thesis and instead read only those portions selected by counsel.

Second, Maxeon applies an erroneous heightened legal standard for reasonable expectation of success that suggests Petitioner must show prior art techniques were commercially viable. No such requirement exists. When the correct legal standard is applied, Dr. Ruby's own deposition testimony corroborates the Petition's core reasonable expectation of success rationale—a POSITA would have known how to successfully implement an oxide layer.

Third, Maxeon's arguments ignore that a POSITA is not an automaton but rather would possess ordinary creativity and ingenuity. Importantly, Dr. Ruby agrees with the Petition's motivation to combine rationale—POSITAs would have been motivated to improve solar cell efficiency, even if by seemingly small amounts, by reducing recombination and contact resistance. In view of this undisputed knowledge, a POSITA would have been motivated to and understood how to implement an oxide layer, as taught by Gan and Borden-575, in Froitzheim and Li.

Maxeon's arguments should be rejected, and the Board should cancel all claims.

**II. THE BOARD SHOULD GIVE NO WEIGHT TO DR. RUBY'S
TESTIMONY REGARDING MOTIVATION TO COMBINE AND
REASONABLE EXPECTATION OF SUCCESS**

Dr. Ruby applied the wrong legal standard for reasonable expectation of success—he believed the probability of success must be “close to 100 percent.” Ex.1075-Ruby-Tr., 165:17-166:8; *Integra Lifesciences I, Ltd. v. Merck KGaA*, 496 F.3d 1334, 1342 (Fed. Cir. 2007) (“when an expert witness’[s] statement of the law is incorrect, that view of the law cannot be relied upon”); *Lg Elecs. Inc. v. Immervision, Inc.*, IPR2020-00179, Paper 26, 26 (P.T.A.B. May 11, 2021) (“[Petitioner’s expert’s] expressed opinion grounded on an incorrect understanding [of] the law fails to support Petitioner’s case.”); *Acorda Therapeutics, Inc. v. Roxane Lab’ys, Inc.*, 903 F.3d 1310, 1333 (Fed. Cir. 2018) (no “requirement of ‘[c]onclusive proof of efficacy’” for reasonable expectation of success) (citations omitted); *In re Longi*, 759 F.2d 887, 896-97 (Fed. Cir. 1985) (“absolute predictability” unnecessary). His declaration with respect to the grounds is also entirely conclusory (perhaps due to having worked only 20 hours on this IPR, (Ex.1075-Ruby-Tr., 10:1-

6, 12:7-12)) and unsupported by evidence. And his declaration and deposition testimony conflict in multiple instances.¹ 37 C.F.R. §42.65(a).

III. GROUND I: CLAIMS 1-4 AND 6-12 ARE OBVIOUS OVER FROITZHEIM AND GAN

Maxeon does not dispute that the Froitzheim-Gan combination teaches every limitation of independent claims 1 and 9. Nor does Maxeon dispute the bulk of the Petition's and Dr. Holman's technical assessments about back junction cells, polysilicon emitters, tunnel oxide layers, motivation to combine, and reasonable expectation of success. *Compare* Ex.1003-Holman-Decl., ¶¶121-145 (identifying supporting references) *with* Ex.2027-Ruby-Decl., ¶¶165-175 (block quoting portions of Gan Thesis without additional evidence). Maxeon instead misapplies the facts and law to argue that a POSITA would not have been motivated to combine the teachings of Froitzheim and Gan with reasonable expectation of success. Ex.1077-Reply, ¶¶15, 19-20.

¹ For example, Dr. Ruby's declaration states "there was no known method for getting the oxide thickness sufficiently reliable" (Ex.2027-Ruby-Decl., ¶172), yet he testified POSITAs would have known how to implement tunnel oxides. Ex.1075-Ruby-Tr., 107:12-108:5.

Maxeon is also incorrect that the Froitzheim-Gan combination fails to teach claim 12. It is legally incorrect to limit claim 12 to an embodiment in the '516 patent's specification and a reference's teachings to its figures, and a POSITA would have understood that screen-printing as taught by Froitzheim results in the structure recited by claim 12. Ex.1077-Reply, ¶21.

A. A POSITA Would Have Been Motivated To Combine Froitzheim And Gan With A Reasonable Expectation of Success

Maxeon does not challenge the Petition's core argument that a POSITA would have been motivated to modify Froitzheim's solar cell to incorporate a polysilicon emitter and oxide, as taught by Gan, to improve Froitzheim's solar cell's efficiency and performance with a reasonable expectation of success—a point the Board agreed with at institution. Institution Decision ("ID"), 28-29. Dr. Ruby concedes Gan teaches "an oxide layer formed between the back surface of the substrate and the emitter layer" and a POSITA would have known how to implement a tunnel oxide. Ex.1075-Ruby-Tr., 107:12-19, 180:20-181:1; Ex.2027-Ruby-Decl., ¶¶77-84 (tunnel oxides and their benefits were known). He also concedes efficiency gains as low as "one-tenth of a percent" would motivate a design change (Ex.1075-Ruby-Tr., 69:6-13), and it was known that "[t]he goal of effective solar cell design is to...*keep[] J_o*

low”² and “[a] *high* ρ_c results in excessive loss of power and lower efficiency.” Ex.2027-Ruby-Decl., ¶¶53, 64; *see also* Ex.1075-Ruby-Tr., 57:5-9, 97:13-22, 99:6-21, 102:3-7, 104:21-105:3, 105:17-21, 106:5-8. Gan’s undisputed polysilicon emitter and oxide layer satisfy the design goals acknowledged by Dr. Ruby: “polysilicon emitters with *low* J_o and ρ_c *can be obtained* with a very small fraction of interfacial oxide breakup” to improve efficiency. Ex.1005-Gan, 245, 249. Ex.1077-Reply, ¶¶22-24.

A POSITA would have therefore understood that applying Gan’s teachings to Froitzheim was a straightforward application of the principles Dr. Ruby concedes were known. Ex.1075-Ruby-Tr., 109:1-9 (agreeing it was known, and Gan studied, that the “combination of a tunnel oxide and doped polycrystalline silicon layer provides excellent passivation and carrier selectivity on the N-type substrate”); *see also id.*, 57:5-9, 99:6-21, 102:3-7, 104:21-105:3, 105:17-21, 106:5-8, 107:12-109:9; Ex.1003-Holman-Decl., ¶¶121-141. The Board need look no further to find obviousness. *See also* Ex.2029-Holman-Tr., 254:4-255:13; Ex.1077-Reply, ¶25.

² Emphasis added unless otherwise noted.

**1. The Gan Thesis Corroborates Gan And Supports The
Froitzheim-Gan Combination**

The POR improperly attacks the Froitzheim-Gan combination by substituting the Gan Thesis for Gan. The Board's Institution Decision correctly rejected this argument as "unpersuasive" and "appear[ing] to advocate for a heightened standard for success." ID, 34 ("Patent Owner's argument relies on the Gan Thesis, not Gan itself."). Maxeon continues to ignore "the proper inquiry" that "'obviousness cannot be avoided by a showing of some degree of unpredictability in the art so long as there was a reasonable probability of success.'" *Id.* The Board should again reject this legally incorrect theory. *See Soft Gel Techs., Inc. v. Jarrow Formulas, Inc.*, 864 F.3d 1334, 1342 (Fed. Cir. 2017) (separate publication did not undermine "reasonable expectation of success" because "absolutely predictability" is not required and such publication did "not imply lack of awareness of the likely result").

If anything, the Gan Thesis *corroborates* a POSITA would have been motivated to incorporate an oxide layer as Gan teaches in Froitzheim's solar cell with reasonable expectation of success.³ Contrary to the POR, the Gan Thesis does

³ Dr. Ruby's Gan Thesis opinions (Ex.2027, ¶¶165-175) should be given little weight because he did not review the entire Gan Thesis before signing his declaration and instead only reviewed portions identified by counsel. Ex.1075-Ruby-Tr., 181:8-18.

not describe a “repeated failure” (POR, 29), and none of Maxeon’s block quotes to the Gan Thesis suggest otherwise when considered in context. Ex.1077-Reply, ¶26.

First, Maxeon ignores that the Gan Thesis explains how oxide layers and polysilicon emitters were previously used in solar cells and semiconductors, which would have motivated a POSITA to pursue oxide layers and polysilicon emitters. Ex.2003-Gan-Thesis, 10, 24-48. Consistent with the Petition and Dr. Holman’s testimony, the Gan Thesis explains the well-developed history of oxide layers and polysilicon emitters, including in the semiconductor technology context that Dr. Ruby agrees is relevant for solar cells. Ex.2003-Gan-Thesis, 1-3, 24-48; Ex.1075-Ruby-Tr., 27:13-22, 109:1-7; Pet., 13, 35-36; Ex.1003-Decl., ¶¶84-85. Maxeon ignores that a POSITA would have been encouraged to use polysilicon emitters and tunnel oxides viewing the well-developed history, as the Gan Thesis describes. ID, 28-29 (“prior art must be considered for all its teachings, not selectively” (quoting *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d. 1324, 1332 (Fed. Cir. 2019))); Ex.2003-Gan-Thesis, 10, 24-48. Ex.1077-Reply, ¶27.

Second, the Gan Thesis’s models and tests support the Froitzheim-Gan combination because they demonstrate that a polysilicon emitter and tunnel oxide layer combination would have desirable characteristics, specifically, desirable J_o and ρ_c values. Ex.2003-Gan-Thesis, 10 (“[A] polysilicon SIS emitter with low J_o and ρ_c

can be obtained by breaking a very small fraction of interfacial oxide.”), 49, 70. Maxeon tries to cast aside the models as “musings,” POR, 31, but Dr. Ruby agrees modeling is “always worthwhile,” as it is a common and valuable technique dating to the 1980s. Ex.1075-Ruby-Tr., 65:20-66:4, 72:5-73:3, 73:22-74:2. Further, the Gan Thesis does not rely on models alone. The Gan Thesis’s tests confirm the model’s predictions—a polysilicon emitter and oxide layer demonstrate improved J_o and ρ_c values resulting in increased efficiency. Ex.2003-Gan-Thesis, 10 (“The results shown in this chapter are very much like what are predicted in Chapter 4.”), 70. A POSITA would have therefore been encouraged to adopt a polysilicon emitter and oxide layer because the Gan Thesis demonstrates with models **and** tests why this technology would succeed. Ex.2003-Gan-Thesis, 10 (“[O]btaining small broken areal fraction of the interfacial oxide seems to be a very promising method for making polysilicon emitters....”). Ex.1077-Reply, ¶¶28-29.

Third, the Gan Thesis’s description of challenges in its experimental setup does not detract from its models and tests demonstrating the benefits of a polysilicon emitter and oxide layer. By simply block quoting portions of the Gan Thesis, Maxeon tells only half the story. Maxeon emphasizes the Gan Thesis’s description of furnace defects during testing, e.g., Ex.2003-Gan-Thesis, 112 (noting oxide growth, despite furnace being filled “with pure argon” and noting that “[t]his may

have to do with the oxygen residue in the furnace”), but Maxeon fails to acknowledge that the Gan Thesis offered a solution for improving manufacturing oxide layers, namely, “performing the oxidation at lower temperature such that the oxidation rate can be controlled more precisely.” Ex.2003-Gan-Thesis, 112. Thus, if anything, the Gan Thesis teaches that a POSITA must employ a furnace that would adequately control oxygen content and therefore oxide layer thickness. It does not discourage combining or expectation of success. It does the opposite: it suggests ways to improve implementing a polysilicon emitter and oxide layer. ID, 34; *Soft Gel*, 864 F.3d at 1342 (“recommendations for future research” support motivation to combine). Ex.1077-Reply, ¶¶30-31.

Even if the Gan Thesis identifies manufacturing challenges for forming an oxide layer, “obviousness cannot be avoided by a showing of some degree of unpredictability in the art[.]” ID, 34. Indeed, Dr. Ruby agrees that a POSITA would have known how to manufacture tunnel oxides. Ex.1075-Ruby-Tr., 107:12-19; *see also id.*, 27:13-22, 109:1-7; POR, 29 (“[T]he art in question is relatively simple....”). A POSITA would have known how to implement a polysilicon emitter and oxide layer considering not only Gan’s undisputed teachings, but also the multiple oxide layer references post-dating Gan and the Gan Thesis, including

Foglietti. *See* Pet., 35-37 (collecting references); Ex.2003-Gan-Thesis, 118; Ex.1042-Foglietti, [0046].⁴ Ex.1077-Reply, ¶32.

2. Polysilicon Emitters And Tunnel Oxide Layers Were Known Features In Semiconductor Technology

A POSITA would also have known how to successfully implement a polysilicon emitter and tunnel oxide layer in Froitzheim because these features were well-known in semiconductor technology (e.g., solar cells and transistors). The Petition and Dr. Holman cite numerous references teaching polysilicon emitters and oxide layers in semiconductor technology. Pet., 34-36 (collective references); Ex.1003-Decl., ¶¶136, 138-141 (same). Maxeon's POR fails to address all of Petitioner's supporting references and misrepresents their teachings. For example,

⁴In the introduction to its opposition to the grounds, Maxeon argues "using Froitzheim's anneal temperature would have eliminated any alleged benefit of [Gan's] oxide layer." POR, 28. The Board should reject this conclusory argument because it lacks any explanation or analysis. To the contrary, a POSITA would have understood Gan and Froitzheim disclose similar and overlapping processing temperatures and known to decrease Froitzheim's processing temperatures as needed. Pet., 36; Ex.1003-Decl., ¶135; Ex.2029-Holman-Tr., 112:1-116:7 (explaining Fisk's law); Ex.1077-Reply, ¶33.

Maxeon limits its Swanson analysis to one sentence (POR, 36 (citing Ex.1015-Swanson, 2:50-53)), and ignores Swanson's robust discussion on forming an oxide layer. Ex.1015-Swanson, 3:35-57. Maxeon's contention that these features were "not known" (POR, 34-37) is wrong and inconsistent with Dr. Ruby's testimony that (1) Gan teaches a "polysilicon emitter" and "oxide layer" on the cell's back surface (Ex.1075-Ruby-Tr., 180:20-181:1), (2) POSITAs would have known how to implement oxide layers (*id.*, 107:12-108:5), and (3) transistor references (e.g., Ex.1042-Foglietti) describing oxide layers are relevant to solar cells. *Id.*, 28:11-22; *see also* POR, 9-10; Ex.2027-Ruby-Decl., ¶81; Ex.1086-Ruby-1990, 3 (describing polysilicon emitter); Ex.1075-Ruby-Tr., 44:18-45:3 (agreeing polysilicon emitters were known); Ex.1077-Reply, ¶¶34-35.

Maxeon's contention that the Petition "blurs the line between generic 'oxide layers' and tunnel oxide layers" (POR, 35-36, n.2) is wrong. The Petition plainly relies on references teaching internal oxide layers (Gan and Borden-575). Pet., 27-28, 64-65. The Petition cites multiple internal and external oxide layer references to demonstrate oxide layers were known and compatible with solar cells, and Dr. Ruby agrees oxide layers were known and compatible with solar cells. Pet., 34, Ex.1003-Holman-Decl., ¶136; Ex.2027-Ruby-Decl., ¶57; Ex.1075-Ruby-Tr., 107:12-108:5, 109:1-7, 180:20-181:1.

Maxeon also improperly demands a degree of detail regarding the known steps for creating an oxide layer that the '516 patent does not itself disclose. That is not a proper basis to rebut obviousness. Indeed, the '516 patent assumes a POSITA would have understood how to manufacture oxide layers, as it describes manufacturing an oxide layer without specific implementation details. The prior art's disclosure cannot be held to a higher standard than the challenged patent's disclosure. *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1339 (Fed. Cir. 2020) (specification's silence "suggest[s] that a [POSITA] was more than capable of selecting between the known methods"); *Hesai Tech. Co., v. Ouster, Inc.*, IPR2023-01421, Paper 45, 34-35 n.6 (P.T.A.B. Mar. 13, 2025).

Moreover, Maxeon's arguments against the Froitzheim-Gan combination are premised on a misunderstanding of the law of obviousness. As noted, Dr. Ruby's reasonable expectation of success opinion—which Maxeon relies on—assumes probability of success must be "close to 100 percent," which is not the standard. *Ex.1075-Ruby-Tr.*, 165:17-166:8; *Acorda*, 903 F.3d at 1333; *Longi*, 759 F.2d at 896. Maxeon conflates anticipation with obviousness by critiquing the Petition because it "identified no reference that successfully combined a solar cell with polysilicon emitters and a tunnel oxide layer...." POR, 34-35. That too is not the standard—the question "is whether it would have been obvious to a [POSITA] to combine the

relevant disclosures of the two references, not whether each individual reference discloses all of the necessary elements.” *Game & Tech. Co. v. Wargaming Grp. Ltd.*, 942 F.3d 1343, 1352 (Fed. Cir. 2019). Maxeon also criticizes the Petition for not identifying a “commercially introduced” solar cell, but commercial availability is not required. POR, 36; *Galderma Lab ’ys, L.P. v. Tolmar, Inc.*, 737 F.3d 731, 737 (Fed. Cir. 2013) (“Nothing...requires [a patent challenger] to prove obviousness by starting with a prior art commercial embodiment...”); *Trs. of Columbia Univ. v. Illumina, Inc.*, 620 F. App’x 916, 932 (Fed. Cir. 2015) (“[N]o requirement that the closest prior art be commercialized”).

Finally, Maxeon critiques Gan for discussing “test devices” instead of a complete solar cell (POR, 35-36), but that makes no difference factually and Maxeon ignores that a reference “must be considered for everything that it teaches[.]” *CRFD Rsch., Inc. v. Matal*, 876 F.3d 1330, 1349 (Fed. Cir. 2017). Dr. Ruby agrees both that a full solar cell is not required to analyze solar cell features, Ex.1075-Ruby-Tr., 78:13-21 (describing testing he performed on part of solar cell), 103:17-104:11 (full solar cell not required to obtain measurements on cell components), and that Gan’s teachings are applicable to solar cells (Ex.2027-Ruby-Decl., ¶59 (“Gan is...directed to a concentrator [solar] cell.”)). Ex.1077-Reply, ¶36.

B. The Froitzheim-Gan Combination Discloses Claim 12

Claim 12 is directed to a common structure for metal contacts—Maxeon does not argue otherwise. Ex.1075-Ruby-Tr., 116:7-118:3 (agreeing metal contacts were known), 39:18-40:2 (same). Instead, Maxeon improperly seeks to limit claim 12 to embodiments disclosed in Figures 4L and 4K (POR, 41). Maxeon's interpretation disregards the claim's plain language, which simply recites the metal contact is “formed over a layer of silicon dioxide” rather than requiring a specific structure, and violates the rule that embodiments cannot be read into the claims. *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014). Ex.1077-Reply, ¶¶37-38.

Maxeon is incorrect that Froitzheim fails to disclose a “silver formed over a layer of silicon dioxide” for two reasons. **First**, Froitzheim teaches that its rear contacts are formed by screen printing the contacts **over** the silicon dioxide passivation layer. Ex.1004-Froitzheim, [0019], [0030], [0033], [0048], [0050]; Ex.1075-Ruby-Tr., 173:6-174:8 (agreeing Froitzheim discloses screen printed contacts); Pet. 50-51. Dr. Ruby agrees that metal contacts are screen printed by placing metal **over** a solar cell layer and then heating the metal such that it fires through the layer to contact layers internal to the cell. Ex.1075-Ruby-Tr., 40:12-21 (describing “firing through”), 116:7-118:3 (describing screen printing); Ex.2029-

Holman-Tr., 84:13-85:16. And the '516 patent explains that its metal contacts are screen printed. Ex.1001-USP516, 5:50-51, 50:60-63. Thus, Froitzheim's screen printed contacts are formed **over** the layer of silicon dioxide by applying metal paste **over** the silicon dioxide layer and heating the structure such that metal touches the emitter. Ex.1077-Reply, ¶¶39-40.

Second, Maxeon ignores the routine practice of screen printing and instead improperly focuses on Froitzheim's Figure 3 (a basic patent publication graphic). POR, 38-42; *Krippelz v. Ford Motor Co.*, 667 F.3d 1261, 1268 (Fed. Cir. 2012) (citations omitted) ("This court has repeatedly cautioned against overreliance on drawings that are neither expressly to scale nor linked to quantitative values in the specification."). As Dr. Ruby admits, screen printing involves heating metal such that it "fires through" the passivation layer to contact internal layers. Ex.1075-Ruby-Tr., 116:7-118:3; Ex.2029-Holman-Tr., 84:13-85:16. "Firing through" does not, as Maxeon asserts, result in the metal contact completely etching away the passivation layer so the metal contacts are "between" the passivation layer. POR, 38. The process instead results in metal "filaments" reaching through the passivation layer but "most" of the metal would remain "on top of" or "over" the passivation layer. Ex.2029-Holman-Tr., 84:13-85:16. Maxeon ignores Dr. Holman's testimony and the well-established fundamental principles of screen printing as confirmed by

supporting references and instead solely relies on its expert's conclusory and unsupported contentions. *See* Ex.1077-Reply, ¶¶41-44; Ex.1081-Pysch, Fig.14; Ex.1083-Liang, 105-106; Ex.1084-Cabrera, 110; Ex.2027-Ruby-Decl., ¶¶181-193.

IV. GROUND III: CLAIMS 1-4 AND 6-12 ARE OBVIOUS OVER FROITZHEIM AND BORDEN-575

Maxeon's narrow challenges to Ground III are wrong. Maxeon's suggestion that Borden-575 is not prior art misunderstands what a provisional must disclose to establish priority. And its suggestion that Borden-575 should be disregarded, notwithstanding that it teaches a polysilicon emitter and oxide layer, because interfacial oxides were supposedly too difficult to manufacture conflicts with both experts' testimony and technical papers explaining otherwise. Ex.1077-Reply, ¶45.

A. Borden-575 Is Prior Art Because The Borden Provisional Provides Written Description Support For Claim 1 And The Relevant Portions of Borden-575

Maxeon is incorrect that Borden-575 is not prior art (POR, 20-24) because the Petition demonstrates the Borden-575 Provisional (1) supports at least one claim in Borden-575 and (2) includes the relevant subject matter of Borden-575. That is all that is required. Pet., 21. The Petition made this showing by identifying (1) where the Provisional discloses Borden-575's claim 1 and (2) where all relevant portions of Borden-575 are disclosed in the Provisional. Pet., 21-22; Ex.1003-Holman-Decl., ¶112; Ex.1077-Reply, ¶46.

For Borden-575's claim 1, Maxeon misapplies the applicable standard by identifying a single, non-substantive difference between Borden-575's claim 1 ("semiconductor substrate") and the Borden-575 Provisional ("semiconductor device" and "substrate"). POR, 20-21. Neither Maxeon nor its expert—who did not address this argument—contend this difference changes the underlying technical disclosure. *Id.* To the contrary, the parties agree solar cells are "semiconductor devices" that use "substrates." See Ex.2027-Ruby-Decl., ¶24 ("One type of semiconductor uses a silicon (Si) substrate..."), 31, 46 (describing solar cell as a "semiconductor device"); Ex.1075-Ruby-Tr., 27:6-9 ("semiconductor physics include solar cells" and "solar cells [are] a type of semiconductor device"), 89:20-22 (generic prior art solar cells include a substrate). Maxeon is incorrect that Borden-575's provisional must use identical words as the later claim. *Union Oil Co. of Cal. v. Atl. Richfield Co.*, 208 F.3d 989, 1001 (Fed. Cir. 2000) (written description does not require identical language). Here, the Petition "demonstrates that [the] provisional application provides written description support for one claim of the non-provisional application." *In re Riggs*, 131 F.4th 1377, 1384-85 (Fed. Cir. 2025). Ex.1077-Reply, ¶47.

Maxeon similarly fails to identify any "relevant portions" of Borden-575's specification that are not disclosed in the Provisional. POR, 21-22. The V_{oc} equation

Maxeon references has no relation to Petitioner's arguments and was a well-known equation. Ex.1076-Ruby-591 (Dr. Ruby's 1999 patent studying V_{oc}); Ex.1075-Ruby-Tr., 130:6-17, 132:2-12, 133:1-4. Both publications disclose "contact holes" and the "tunnel oxide," which were well-known features. *See, e.g.*, Ex.2027-Ruby-Decl., ¶¶71 (describing prior art device having "small holes...formed in this passivating oxide layer"), 77-84 (agreeing tunnel oxides and tunnel current flow were known); Ex.1011-Borden-575-Provisional, Fig.2, [0017]-[0023] (teaching contact holes and tunnel oxides). And Dr. Ruby agrees that tunnel oxides were known and allowed current to "tunnel" through an oxide layer. Ex.2027-Ruby-Decl., ¶¶77-83; Ex.1075-Ruby-Tr., 106:5-19, 107:12-108:5, 109:1-9, 180:20-181:1. The specifications do not need to be identical and any purported missing details (e.g., "details on substrate 200 and contact holes," POR, 23) are irrelevant because the Petition does not rely on them. Borden-575 is therefore prior art because "the provisional...provide[s] written description support for the specific portions of [Borden-575] identified and relied on" by Petitioner. *Riggs*, 131 F.4th at 1384; Ex.1077-Reply, ¶¶48-49.

B. The Petition Is Not Deficient Due To Borden-575's "Buried Oxide" Layer

The Petition explains at length *how* Borden-575 teaches the claimed oxide layer and *where* that disclosure is, as 37 C.F.R. §42.104(b)(4) and §42.22 require.

Maxeon is incorrect that the Foitzheim-Borden-575 ground is “impermissibly vague” or that the Petition had to describe every embodiment within Borden-575’s robust disclosure. POR, 51-55. Ex.1077-Reply, ¶50.

Maxeon’s “impermissibly vague” argument attempts to fabricate ambiguity where none exists. POR, 51-55. As the Petition explains (Pet., 69-70), Borden-575’s “buried oxide” and “tunnel oxide” each meet the challenged claims’ oxide limitation. *See also* Ex.1006-Borden-575, claim 10 (buried oxide “layer is less than about 20Å thick”), [0022] (tunnel oxide “typically 8 to 15Å thick”). Maxeon offers no claim construction that would suggest otherwise. POR, 27. The Petition’s motivation to combine analysis properly focuses on why a POSITA would have been motivated to obtain benefits by “implementing Borden-575’s polysilicon emitter and ***tunnel oxide layer*** to the backside configuration taught by Froitzheim.” Pet., 65. This is because “Borden 575’s tunnel oxide layer” is required “in order to make a functioning solar cell.” Ex.2029-Holman-Tr., 243:9-17. Borden-575 also teaches “its tunnel oxide layer doesn’t necessarily have to cover the entire wafer surface, and that its other oxide layer may also occupy some of the wafer surface.” Ex.2029-Holman-Tr., 243:9-17. Thus, a POSITA would have understood that omitting the buried oxide—either partially or in full—while maintaining a tunnel oxide was a design tradeoff to ensure proper current flow through the cell and minimize

recombination. Ex.2027-Ruby-Decl., ¶¶64 (cell design involves “several tradeoffs and careful optimization”); Ex.1075-Ruby-Tr., 31:21-32:1, 105:4-21; Ex.1077-Reply, ¶¶51-53.

None of Maxeon's cited cases in support of its “impermissibly vague” argument (POR, 51-53) applies here. Maxeon cites *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359 (Fed. Cir. 2016), but that case involved an argument “raised for the first time in [a] reply brief and expert declaration.” *Id.* at 1369; POR, 51. In *Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1372 (Fed. Cir. 2023), the Federal Circuit agreed the Board did not need to consider an argument based on the incorporation by reference of “approximately 40 exhibits totaling 1,300 pages, in addition to claim charts exceeding 100 pages” accompanied by briefs that “minimally cited small portions of that material...without meaningful explanation.” 70 F.4th at 1369; POR, 53. In *VIZIO, Inc. v. Nichia Corp.*, IPR2017-00551, Paper 9, 9-12 (P.T.A.B. July 7, 2017), the Board denied institution because the petition quoted prior art without explanation or analysis. In *Ivantis, Inc. v. Glaukos Corp.*, IPR2018-01180, Paper 14, 14 (P.T.A.B. Dec. 6, 2018), the Board denied a motion to correct the petition when it relied on a non-prior art reference.

C. A POSITA Would Have Been Motivated To Combine Froitzheim And Borden-575 With Reasonable Expectation of Success

Maxeon's remaining arguments against the Froitzheim-Borden-575 combination (POR, 54-65) fail. Ex.1077-Reply, ¶54.

First, implementing Borden-575's polysilicon emitter and tunnel oxide layer in Froitzheim would have been straightforward and not "too difficult to implement" as Maxeon contends (POR, 55-59). *See* Pet., 64-67; Ex.1003-Holman-Decl., ¶¶224-231. Dr. Ruby's testimony contradicts Maxeon's arguments; he admitted that tunnel oxides and their benefits were known (Ex.1075-Ruby-Tr., 106:5-19, 109:1-9, 180:20-181:1) and a POSITA would have known how to implement a tunnel oxide (*id.*, 107:12-108:5). *See also* Ex.1006-Borden-575, [0005] (explaining tunnel oxides were "well known"). Maxeon's attempt to inject the Gan Thesis into the Borden-575 ground fails for the same reasons discussed in Section III.A. POR, 56; Ex.1077-Reply, ¶¶55-56.

Second, the fact that Borden-575's background describes a prior art solar cell that was not "commercially introduced" (POR, 56-57) is irrelevant. *Galderma*, 737 F.3d at 737; *Columbia*, 620 F. App'x at 932. Regardless, as described above, Dr. Ruby's testimony contradicts Maxeon's argument. Ex.1075-Ruby-Tr., 106:5-19, 107:12-108:5, 109:1-9, 180:20-181:1.

Third, Maxeon's assertion that Borden-575's tunnel oxide "is not commercially viable" (POR, 58) again misstates the legal standard—commercial viability is not required. *Acorda*, 903 F.3d at 1333; *Longi*, 759 F.2d at 896. This too is contradicted by Dr. Ruby's testimony. Ex.1075-Ruby-Tr., 106:5-19, 107:12-108:5, 109:1-9, 180:20-181:1; Ex.1077-Reply, ¶57.

Fourth, Maxeon's discussion comparing Borden-575's and Gan's temperatures incorrectly treats a POSITA as an automaton. POR, 57-59. A POSITA would have readily understood how to adjust Gan's ranges to successfully implement an oxide layer while maintaining the solar cell's integrity. Ex.1075-Ruby-Tr., 31:21-32:1, 105:4-21, 107:12-108:5; Ex.1077-Reply, ¶¶58-59.

Fifth, contrary to Maxeon's suggestion (POR, 59-65), a POSITA would have understood how to implement Borden-575's oxide layer without a buried oxide or contact holes. As the Petition explains, a POSITA would have been motivated to apply the known benefits of Borden-575's polysilicon emitter and **tunnel oxide** to Froitzheim. Pet., 65. Again, Dr. Ruby's testimony that a POSITA would have known how to implement a tunnel oxide contradicts Maxeon's arguments. Ex.1075-Ruby-Tr., 106:5-19, 107:12-108:5, 109:1-9, 180:20-181:1; Ex.1077-Reply, ¶60.

Finally, Maxeon's assertion that the Borden Provisional does not teach tunnel oxide benefits (POR, 23, 65) ignores the Provisional's disclosure and a POSITA's

knowledge. The Provisional teaches tunnel oxides “provide[] passivation between the substrate and the polysilicon, as described in the prior art,” (Ex.1011-Borden-Provisional, [0018]), and Dr. Ruby agrees tunnel oxides allow current to “tunnel” through an oxide layer. Ex.2027-Ruby-Decl., ¶¶77-83; Ex.1075-Ruby-Tr., 106:5-19, 107:12-108:5, 109:1-9, 180:20-181:1. Maxeon’s assertion that the Provisional does not disclose that a tunnel oxide “allow[s] for tunnel current flow” is meritless. Ex.1077-Reply, ¶61.

D. The Froitzheim-Borden-575 Combination Discloses Claim 12

Maxeon’s claim 12 arguments for the Froitzheim-Borden-575 combination are identical to its Froitzheim-Gan arguments (POR, 65-66) and fail for the same reasons discussed in Section III.B. Ex.1077-Reply, ¶62.

V. GROUND V: CLAIMS 1-2 AND 8-11 ARE OBVIOUS OVER LI AND GAN

Maxeon concedes the Li-Gan combination teaches every limitation of the ground’s challenged claims and are analogous art, and Dr. Ruby does not contest a POSITA would have had a reasonable expectation of success at combining Li and Gan. Maxeon’s argument that “the Gan Thesis teaches that Gan’s interfacial oxide could not be reliably grown” (POR, 66-67) fails for the same reasons discussed in Section II.A.1. Ex.1077-Reply, ¶¶63-64.

Maxeon has one, narrow argument unique to Ground V—that Li “teaches away” from Gan (POR, 67-69), which also fails. A reference “teach[es] away when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant’s invention.” *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005). But “[a] statement that a particular combination is not a preferred embodiment does not teach away absent clear discouragement of that combination.” *Id.*

Here, none of Li’s teachings would discourage a POSITA from modifying Li’s solar cell in view of Gan. Maxeon’s teaching away argument relies on a preferred embodiment in Li that diffuses the solar cell’s layers at a temperature less than “800-1000°C.” POR, 67-68; Ex.1008-Li, 4. However, Li’s disclosure is not limited to diffusion at a lower temperature range. Most of Li’s disclosure concerns Li’s cell structure. *See* Ex.1008-Li. Li’s preference of “avoid[ing]” a certain temperature range does not suggest that Li’s structure could not be manufactured at Gan’s disclosed temperatures. Ex.1008-Li, 5; Ex.1005-Gan, 246. While Dr. Ruby argues in his declaration that Li and Gan are “in conflict,” Ex.2027-Ruby-Decl., ¶¶268-280, he never suggests Li’s structure could not be made at temperatures above 800-1000°C and he agreed when deposed that POSITAs would have known how to “perform [dopant] diffusion.” *See* Ex.2027-Ruby-Decl., ¶¶268-80; Ex.1075-Ruby-

Tr., 46:22-47:16, 146:4-7. A POSITA would have understood diffusion processing temperatures were a routine consideration and easily adjustable, and there were different “trade-offs” associated with creating the cell at higher and lower temperatures, such as processing time and diffusion depth. Ex.2027-Ruby-Decl., ¶¶64; Ex.1075-Ruby-Tr., 31:21-32:1, 105:4-21; Ex.1077-Reply, ¶¶65-67.

Maxeon's cases also do not support teaching away here. For instance, in *Allergan, Inc. v. Sandoz Inc.*, 796 F.3d 1293, 1305 (Fed. Cir. 2015), the prior art described a “widespread concern” that the patent's ingredient was a “natural-born killer.” In *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068-69 (Fed. Cir. 2016), the prior art taught away from modifying a design that would remove a feature that was “the primary objective of the reference.” As discussed, Li does not state a diffusion temperature lower than 800-1000°C is necessary to create a functioning cell having Li's structure. Accordingly, Li's disclosure does not “teach away” from Gan.

VI. GROUNDS II, IV: CLAIM 5 IS OBVIOUS IN VIEW OF SHEATS

Maxeon's expert concedes all the bases of Petitioner's core argument for claim 5: a “trench” was a well-known solar cell feature; Sheats teaches a “trench”; and Sheats uses “trenches” to prevent shorts, which are undesirable in solar cells.

Pet., 60-63; Ex.1075-Ruby-Tr., 46:3-5, 46:14-17, 191:6-192:10, 193:17-22, 196:18-22. Ex.1077-Reply, ¶¶68-69.

Maxeon's arguments do not detract from these concessions. Maxeon incorrectly argues Sheats' trench is "superfluous" given Froitzheim's disclosure that "a separation at the edge of the wafer may be performed, e.g. in a plasma." POR, 43. Froitzheim generally discloses edge isolation, which is a technique to prevent short circuits. Ex.1004-Froitzheim, [0047]. Sheats' "trench" is also an edge isolation technique, and the experts agree that a trench can be created in different ways (Ex.2029-Holman-Tr., 159:17-18; Ex.1075-Ruby-Tr., 191:6-13, 194:1-4). Therefore, while Sheats provides additional details on the trench that Froitzheim assumes a POSITA would know, at a minimum, Froitzheim suggests applicability of a trench by explaining its cell may include edge isolation. Ex.1077-Reply, ¶70.

Even if plasma etching differs from a trench (POR, 44-45), a POSITA would have been motivated to combine the teachings of Froitzheim and Sheats. Froitzheim teaches that using plasma is one possible technique, and Dr. Ruby agrees that a POSITA would have known of different edge isolation techniques. *See* Ex.2027-Ruby-Decl., ¶197; Ex.1075-Ruby-Tr., 191:6-9. Therefore, a POSITA would have understood that a trench was one successful edge isolation technique and would have

been motivated to use this technique in Froitzheim to prevent short circuits. Ex.1077-Reply, ¶71.

Maxeon's argument that Sheats is limited to "solar cell arrays" (POR, 45-50) incorrectly assumes a POSITA would have constrained Sheats' teachings to a particular embodiment and not Sheats' broader disclosure. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012) ("reference must be considered for everything that it teaches"). A POSITA would have understood trenches are physically and functionally similar, regardless whether the trench was used to prevent a "short circuit within" the cell or "between two or more solar cells in array formation," and Dr. Ruby agrees that short circuits are issues for solar arrays and cells. POR, 42, 45; Ex.1075-Ruby-Tr., 186:15-187:1, 188:10-13, 189:21-190:3; Ex.1077-Reply, ¶72.

Finally, Maxeon's attorney argument that "Sheats' trench is cut up 'to' the substrate layer, not 'into' the substrate as claim 5 recites" is meritless. POR, 42; Ex.2027-Ruby-Decl., ¶¶194-225. Sheats teaches the trench is "formed *through* the transparent conductive layer and the active layer *to the bottom electrode* 506 as shown in FIG. 5D." Ex.1012-Sheats, [0059]; Ex.1077-Reply, ¶73 ("conductive" and "active" layers form Sheats' pn junction and are equivalent to a substrate-emitter configuration).

VII. CONCLUSION

For the reasons above and in the Petition, the challenged claims should be found unpatentable.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

I hereby certify that the foregoing, Petitioner's Reply, contains 5,575 words as measured by the word processing software used to prepare the document, in compliance with 37 C.F.R. §42.24(d), excluding the parts of the Petition exempted from the word count by 37 C.F.R. §42.24(a)(1).

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CERTIFICATE OF SERVICE

I hereby certify that, on August 14, 2025, I caused a true and correct copy of the following materials:

- Petitioner's Reply
- Petitioner's Table of Exhibits
- Exhibits 1071-1086, 1088
- Certificate of Compliance Regarding Word Count

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Petitioner's Table of Exhibits

No.	Description
1001	U.S. Patent No. 8,222,516 B2 ("USP516")
1002	File History for U.S. Patent No. 8,222,516 B2 (App. No. 12/070,742) ("FH516")
1003	Declaration of Dr. Zachary Holman Regarding U.S. Patent No. 8,222,516 B2
1004	EP1732142A1 to Froitzheim ("Froitzheim")
1005	Gan and Swanson, <i>Polysilicon Emitters for Silicon Concentrator Solar Cells</i> , <i>IEEE Conference on Photovoltaic Specialists</i> , Vol. 1, Pages 245-240 (1990) ("Gan")
1006	WO 2009/094575 A2 ("Borden-575")
1007	U.S. Patent No. 6,998,288 to Smith ("Smith")
1008	CN 1949545A to Li (Translation) ("Li")
1009	Translation Declaration for Li
1010	Zachary C. Holman, <i>Electron Transport in Amorphous Silicon</i> (May 2005) (Thesis Presented to The Division of Mathematics and Natural Sciences, Reed College) ("Holman-Thesis")
1011	U.S. Provisional Appl. No. 61/023,354 ("Borden-Provisional")
1012	U.S. Patent App. Pub. No. 2006/0157103 ("Sheats")
1013	Declaration of June Munford
1014	Complaint for Patent Infringement, <i>Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp., et al.</i> , Civil Action No. 2:24-cv-262 (E.D. Tex. Apr. 19, 2024), ECF No. 1 ("Complaint")
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1037	U.S. Patent No. 8,878,053 B2 ("USP053")
1038	File History for U.S. Patent No. 8,878,053 B2 (App. No. 13/495,577) ("FH053")
1039	File History of U.S. Patent App. No. 14/504,771 ("771FH")
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1066	U.S. Patent No. 4,748,130 to Wenham ("Wenham")
1067	Email chain between Counsel and Trial Board, dated December 11-12, 2024
1068	Plaintiff Maxeon Solar Pte. Ltd.'s Disclosure of Asserted Claims and Infringement Contentions, <i>Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp., et al.</i> , Civil Action No. 2:24-cv- 262 (E.D. Tex. Nov. 21, 2024)
1069	Docket Control Order, <i>Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp., et al.</i> , Civil Action No. 2:24-cv- 262 (E.D. Tex. Nov. 25, 2024), ECF No. 33
1070	Declaration of Mark D. Selwyn in Support of Petitioner's Notice of Intent to Designate Mark D. Selwyn, a Provisionally Recognized PTAB Attorney, as Back-Up Counsel Pursuant to 37 C.F.R. § 42.10(c)
1071	Deposition Transcript of Douglas S. Ruby, Ph.D., June 24, 2025, in <i>Canadian Solar, Inc. v. Maxeon Solar Pte, Ltd.</i> , IPR2024-01039, IPR20024-01040 ("Ruby-CSI-Dep.")
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