

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 IPR2024-01198
U.S. Patent No. 11,251,315

**PATENT OWNER'S PRELIMINARY RESPONSE
UNDER 37 C.F.R. § 42.107(a)**

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PATENT OWNER'S EXHIBIT LIST

Exhibit No.	Description
2001	Declaration of David Carroll, Ph.D. in Support of Patent Owner Preliminary Response
2002	Lamers et al., “Towards 21% Efficient N-CZ IBC based on Screen Printing,” <i>26th European Photovoltaic Solar Energy Conference and Exhibition</i> , (2011)
2003	Desa et al., “Optimization of p-type Screen Printed Interdigitated Back Contact Silicon Solar Cell with Aluminum Back Surface Field,” <i>International Journal of Engineering & Technology IJET-IJENS</i> , 14(2) (2014)
2004	Pham et al., “Dopant-grading proposal for polysilicon passivating contact in crystalline silicon solar cells,” <i>Journal of Power Sources</i> , 522, 2022
2005	Procel et al., “Analysis of the Impact of Doping Levels on Performance of Back Contact – Back Junction Solar Cells,” 4th International Conference on Silicon Photovoltaics, SiliconPV 2014, Italy, 2014, pp 128-132, ScienceDirect
2006	Federal Court Management Statistics (September 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	<i>Intentionally Left Blank</i>
2011	<i>Intentionally Left Blank</i>
2012	<i>Intentionally Left Blank</i>
2013	<i>Intentionally Left Blank</i>
2014	<i>Intentionally Left Blank</i>

Exhibit No.	Description
2015	<i>Intentionally Left Blank</i>
2016	“Nanotechnology improves solar cell efficiency,” <i>EarthSky</i> , August 28, 2007 (accessible at https://earthsky.org/human-world/nanotechnology-improves-solar-cell-efficiency ; last accessed October 14, 2024)
2017	“New Plastic Solar Cell Breaks Efficiency Record,” <i>ScienceDaily</i> , April 20, 2007 (accessible at https://www.sciencedaily.com/releases/2007/04/070419140902.htm), last accessed October 14, 2024)
2018	Capshaw-Mack, C., “Project seeks to improve methods of harnessing solar,” <i>Winston-Salem Journal</i> , August 4, 2013 (accessible at https://journalnow.com/news/local/article_1d243ff0-fc9e-11e2-b607-001a4bcf6878.html ; last accessed October 15, 2024)
2019	<i>Intentionally Left Blank</i>
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)

I. INTRODUCTION

The Board should deny Petitioner Hanwha Solutions Corporation’s (“Hanwha”) Petition for *inter partes* review, which challenges claims 10-20 (the “Challenged Claims”) of U.S. Patent No. 11,251,315 (“the ’315 patent”) in three separate Grounds. In Grounds I and III, Hanwha challenges independent claim 10 by improperly carving out two limitations—one related to dopant concentration and the other to metal impurities—without evaluating how the ’315 patent specification explains that these two limitations intertwine and produce unexpected performance improvements in solar cell technology. Yet, even considering the dopant concentration and the metal impurity limitations separately, Hanwha’s arguments fail. For these same reasons, Ground II (which only challenges dependent claim 18) also fails because of claim 18’s dependency from claim 10. Additional flaws are evident in Ground II, as Hanwha fails to show why a person of ordinary skill in the art (POSITA) would have been motivated to modify the primary reference Choi (EX1006) to incorporate a trench region, as required by claim 18. As summarized below, all of Hanwha’s grounds are fatally flawed.

First, regarding the dopant concentration limitation of claim 10 and for all Grounds, Hanwha relies on outdated and incompatible solar cell teachings in secondary references Granek (EX1010) and Marvin (EX1008) to modify primary references Choi and Cousins (EX1007). Hanwha ignores Granek’s and Marvin’s

teachings of solar cell structures as a whole and impermissibly cherry-picks their dopant concentration recommendations to arrive at the claimed “dopant concentration.” Moreover, Hanwha, fails to show why a POSITA would have been motivated to implement Granek’s or Marvin’s dopant concentration in Choi or Cousins, in view of optimum dopant concentrations—higher than the claimed “dopant concentration”—for solar cell configurations compatible with Choi and Cousins, such as Lamers (EX2002), Desa (EX2003), and Procel (EX2005).

Second, regarding the metal impurity limitation of claim 10 and for all Grounds, Hanwha’s arguments oversimplify the prior art. Indeed, Hanwha overlooks fatal weaknesses in secondary reference Istratov (EX1012) when combining Istratov with primary references Choi and Cousins. For Grounds I and II, in its Choi-Istratov-based combination, Hanwha relies on impermissible hindsight and fails to consider how the proposed combination would change Choi’s principle of operation. And similarly for Ground III, in its Cousins-Istratov-based combination, Hanwha again relies on impermissible hindsight and fails to consider how the proposed combination would degrade Cousins’s solar cell performance.

Third, regarding the trench region limitation of claim 18 and for Ground II, Hanwha fails to articulate why it would have been obvious to a POSITA to modify Choi with Smith (EX1011), despite Choi’s contradictory teaching from such modification. Hanwha provides no explanation for why a POSITA would have

been motivated to implement Smith's trench in Choi, in view Choi's solar cell that already includes the same function for achieving the same alleged benefits as Smith's trench.

Fourth, the *Fintiv* factors weigh in favor of exercising discretion to deny institution under 35 U.S.C. § 314(a). Hanwha's Petition does not present a compelling unpatentability challenge that would otherwise warrant institution.

The technical arguments presented in this Preliminary Response are supported by the expert testimony of Dr. David Carroll (EX2001).

For the reasons summarized above and detailed below, Maxeon respectfully requests that the Board deny institution of this IPR and preserve the judicial resources of the Board and the parties.

II. OVERVIEW OF THE '315 PATENT

A. The '315 Patent

The '315 patent discloses novel "solar cell fabrication techniques to improve solar cell lifetime, passivation and/or efficiency" (EX1001, 3:17-18) in tunnel oxide passivated contact ("TOPCon") solar cell configurations.¹ "Efficiency is an

¹ While the TOPCon moniker was not coined until 2013 by researchers at the Fraunhofer Institute for Solar Energy Systems, SunPower had been developing and optimizing solar cells employing tunnel oxide layers between the silicon

important characteristic of a solar cell as it is directly related to the solar cell's capability to generate power.” *Id.*, 1:35-37. As explained below, charge carrier lifetime and surface passivation are inter-related characteristics. Improving one has the potential to negatively impact the other or increase the cost and complexity of the solar cell. But the solar cell covered by the Challenged Claims provides improvements in *both* of these performance characteristics *and* a boost in solar cell efficiency.

Charge Carrier Lifetime. The “lifetime” of charge carriers in a solar cell refers to the average time that electrons and holes can exist before recombining. EX2001, ¶40. The longer the charge carriers can remain separate, the greater the chance they have to reach electrical contacts of the solar cell and contribute to current output, thus increasing the solar cell's efficiency. *Id.* Accordingly, a “[h]igher lifetime is preferred for high efficiency solar cells.” EX1001, 9:35-36; EX2001, ¶40. To improve the lifetime of charge carriers, manufacturers often use high-quality, pure semiconductor materials and carefully control the manufacturing process to reduce defects within the crystal lattice. EX1084, 11 (“SunPower is using wafers with lifetimes greater than 1 millisecond.”); EX2001, ¶40. These defects can act as recombination centers where electrons and holes prematurely

substrate and doped polysilicon regions prior to 2013.

recombine, reducing the lifetime of charge carriers. EX2001, ¶40. These higher-grade materials and more stringent manufacturing controls, however, increase costs.² *Id.*

Passivation. “Surface passivation” involves the treatment of a solar cell’s surface to reduce the number of recombination sites available. EX2001, ¶41. This is typically achieved by creating a thin insulating layer (such as silicon nitride or aluminum oxide) on the surface of the semiconductor material, which can prevent charge carriers from recombining at the surface. *Id.* The ’315 patent states that “[l]ower surface passivation is preferred for high efficiency solar cells.” EX1001, 9:27-28; EX2001, ¶41. The deposition of passivation layers requires additional steps in the production process, which can increase the time and resources needed to manufacture solar cells. EX2001, ¶41. Moreover, if not carefully optimized, the passivation layer can introduce electronic defects or impede the collection of charge carriers, potentially reducing the overall efficiency. *Id.*

² Additionally, the processes used to improve lifetime, such as thermal treatments, can introduce other challenges, such as increased stress within the solar cell, which can affect its mechanical stability. *Id.*

B. The '315 Patent's Novel Solar Cell Fabrication Technique

The '315 patent discloses a solar cell fabricated by (1) forming a dielectric region (e.g., a tunnel oxide layer) over a silicon substrate, (2) forming an emitter region over the dielectric region, (3) forming a dopant region (e.g., a dopant source layer) on a surface of the silicon substrate, and (4) heating the solar cell above 900 degrees Celsius such that the surface of the solar cell is doped to a concentration of less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ and the emitter region contains contaminants gettered from the silicon substrate through the dielectric region. EX2001, ¶42. These fabrication steps are illustrated in FIGs. 1-4 (annotated below).³

³ Throughout its Petition, Hanwha alleges that the solar cell design disclosed in the '315 patent is a “back-contact solar cell” to draw comparisons with the asserted reference. However, the '315 patent is not limited to a “back contact solar cell.” EX1001, 7:13-14. In fact, independent claims 1 and 10 require only a single emitter region and contact (e.g., a first emitter region and a first metal contact). For claim 1, the emitter and metal contact are on the front side of the solar cell, and—for claim 10—they are on the back side. Dependent claim 20 is the first limitation that requires both “P-type” and “N-type doped polysilicon region[s]” formed on the back side of the solar cell, which is a “back contact solar cell” configuration.

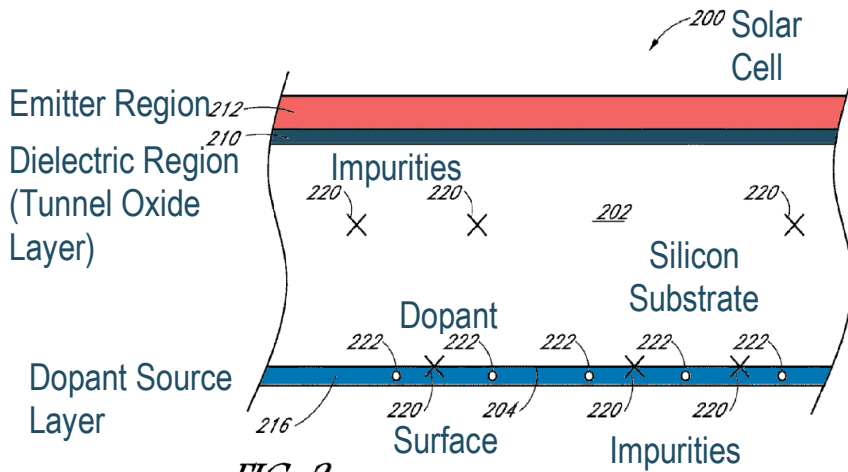


FIG. 2

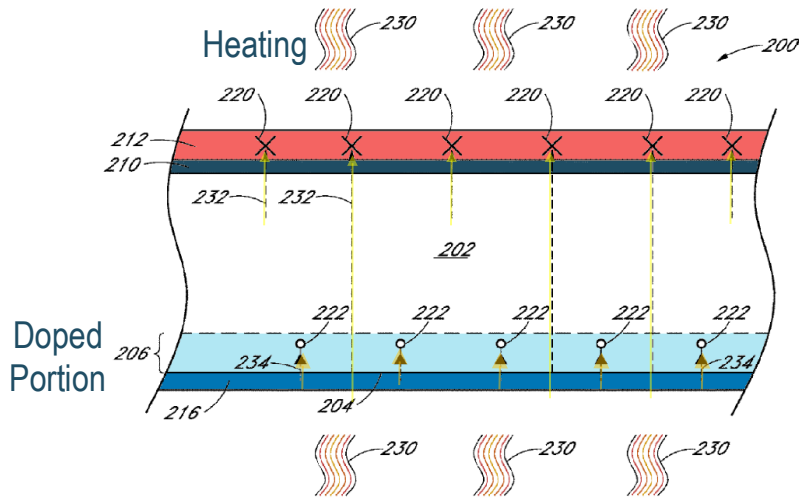


FIG. 3

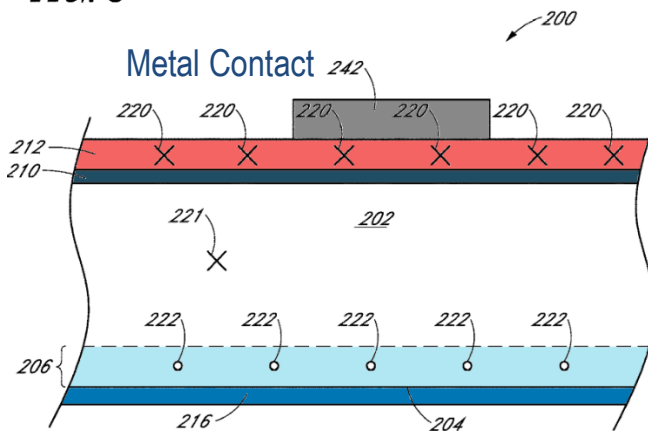


FIG. 4

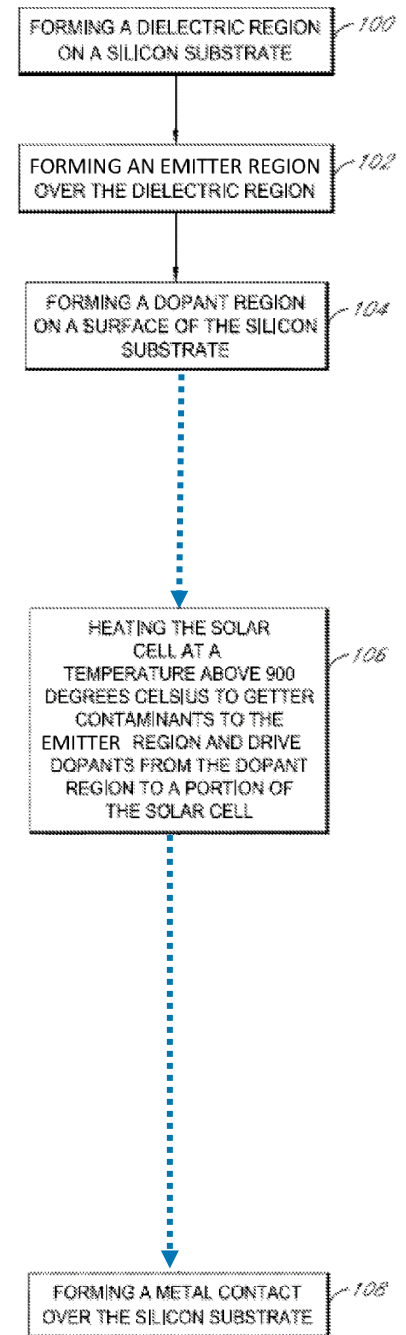


FIG. 1

EX1001, FIGs. 1-4 (annotated).

The '315 patent explains (and summarizes in FIG. 11) that this particular combination of steps to form a solar cell provided increased efficiency that was both unique and unexpected. Figure 11 shows four processes where the heating temperature and surface dopant concentrations were varied and the gettering location, surface passivation, lifetime, and efficiency results were measured.⁴ EX1001, FIG. 11 (below, color annotations added).

⁴ Maxeon agrees that an inadvertent error was made in FIG. 11 that shows all the temperature settings to be less than or equal to 900 degrees Celsius. Pet., 21 n.3. The original application included the same information as Table 1 in the specification, which was later amended to be FIG. 11. EX1002, 43. Table 1 in the original application correctly shows that the Example Processes C and D in FIG. 11 should have temperature settings at *greater than* 900 degrees Celsius as described in the text. *Id.*

	Variable			Results			
	Example Process	S Temp	Surface Dopant Conc.	Gettering Location	Surface Passivation	Lifetime	Efficiency
	A	≤ 900 deg-C	2x10 ¹⁸ cm ⁻³	non-poly	2fA/cm ²	~3msec	Baseline
	B	≤ 900 deg-C	4x10 ¹⁸ cm ⁻³	non-poly	5fA/cm ²	~10msec	Baseline
> 900 deg-C	C	≤ 900 deg-C	2x10 ¹⁸ cm ⁻³	poly	2fA/cm ²	~10msec	+0.5 % abs.
> 900 deg-C	D	≤ 900 deg-C	4x10 ¹⁸ cm ⁻³	poly	5fA/cm ²	~10msec	Baseline

Table 1. Example Processes for Solar Cell Fabrication

FIG. 11

EX1001, FIG. 11 (annotated).

In Example Process A, low temperature (e.g., ≤ 900 degrees Celsius) heating and low surface dopant concentration (e.g., $2 \times 10^{18} \text{ cm}^{-3}$) were used. The '315 patent explains that “[o]xides and/or tunnel oxides, such as the dielectric region . . . , can be barriers to gettering of the metal impurities 220 to emitter regions” and that “heating at temperature at 900 degrees Celsius or below can be insufficient to diffuse metal impurities through a tunnel oxide and into a polysilicon region.” EX1001, 5:15-20. Accordingly, the “Gettering Location” for Example Process A is the “non-poly” silicon substrate, rather than the “poly” emitter region. The combination of low temperature gettering and low surface dopant concentration allows for good surface passivation, but poor lifetime. EX2001, ¶44.

Example Process B also uses low temperature heating, but a higher surface dopant concentration (e.g., $4 \times 10^{18} \text{ cm}^{-3}$). Like Example Process A, the gettering location remains in the “non-poly” silicon substrate. The low temperature gettering and higher surface dopant concentration results in a good lifetime, but poor surface passivation. EX2001, ¶45. Example Processes A and B demonstrate the kind of trade-offs that are made when designing solar cells. Having a low surface dopant concentration results in good surface passivation, but poor lifetime; whereas a high surface dopant concentration results in good lifetime, but poor surface passivation. *Id.* For both processes, the efficiency of the solar cell remained the same. *Id.*

The unexpected result came from Example Process C, where high-temperature (e.g., > 900 degrees Celsius) heating and low surface dopant concentration are used. In this process, contaminants from the silicon substrate getter through the dielectric region and into the “poly” emitter region. EX2001, ¶46. At the same time, dopants are driven deeper into the silicon substrate from the surface of the silicon substrate resulting in a lower surface dopant concentration. *Id.* At the time of the invention, it was not known whether high-temperature heating would getter contaminants through the dielectric region, while leaving this region intact and functional, or whether there would be some split between contaminants gettered between the surface of the “non-poly” silicon substrate and the “poly” emitter region, such that lifetime would not show any improvement

(which was the case for Example Process D, described below). *Id.* Further, a POSITA would not have expected lifetime to improve by high-temperature heating because the silicon substrate also contains oxygen defects, which would be enlarged at higher temperatures and increase the likelihood of Ingot Ring Defects (IRD), which would reduce lifetime. *Id.* Example Process C, however, provided both improved surface passivation and lifetime, resulting in a 0.5 % increase in efficiency over the other example processes. *Id.*

Example Process D also produced an unexpected result in that high-temperature (e.g., > 900 degrees Celsius) heating did not further improve the lifetime beyond what a high surface dopant concentration already produced in a TOPCon solar cell configuration (e.g., Example Process B). Thus, Example Process D demonstrates that a high-temperature heating step alone does not yield improved efficiency in the claimed solar cell configuration unless the surface dopant concentration is low. *Id.*, ¶47. In other words, the '315 patent requires a specific combination of fabrication steps and surface dopant concentration to improve the performance of a particular solar cell structure. *Id.*

C. The '315 Patent Prosecution History

The Examiner agreed that the claimed invention was patentable:

4. The following is an examiner's statement of reasons for allowance: Claims **1 – 20** are allowable over the prior art of record because none of the prior art whether taken singularly or in combination, especially when these limitations are considered within the specific combination claimed, to teach:

portion of the silicon substrate is formed at the back side of the solar cell and a first dielectric region formed over the silicon substrate, wherein the first dielectric region is formed over the front side of solar as recited in the independent claim **1**; and portion of the silicon substrate is formed at the front side of the solar cell; a dielectric region formed over the silicon substrate, wherein the dielectric region is formed over the back side of solar; a first emitter region having metal impurities formed over the dielectric region as recited in the independent claim **10**.

EX1002, 207. While the Examiner allowed these claims without issuing any rejections, nothing indicates that the '315 patent did not receive a thorough examination. In fact, a significant number of references cited during prosecution resulted from previous searches in related patents. The '315 patent is the fifth issued patent in its family, which all had the same primary examiner.

III. PERSON OF ORDINARY SKILL IN THE ART

Hanwha's declarant, Dr. Zachary Holman, states that "a person of ordinary skill in the art as of the claimed priority date of the '315 patent [POSITA] would have had (1) an advanced degree in applied physics, chemistry, electrical engineering, materials science, mechanical engineering, or a related discipline and (2) at least one year of experience designing, developing, or researching the design and/or manufacture of solar cells or related technologies." EX1003, ¶39; *see also* Pet. 23-24. Dr. Holman also asserts that, "[a]lternatively, a POSITA would have

had (1) a bachelor's degree in one of the aforementioned disciplines and (2) at least two years of experience designing, developing, or researching the design and/or manufacture of solar cells or related technologies” and that “[a]dditional work experience may compensate for less formal education, and vice versa.” *Id.* For the purposes of this Preliminary Response, Maxeon applies Hanwha's level of ordinary skill.

IV. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD OF PREVAILING ON ANY CHALLENGED CLAIM.

In an IPR, “the burden of proving a proposition of unpatentability” is borne by (and remains at all times with) the petitioner. 35 U.S.C. §§ 314(a), 316(e); *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016). To satisfy its burden, a petitioner must “articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness”—“mere conclusory statements” will not suffice. *Magnum Oil*, 829 F.3d at 1380. Indeed, “[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (quoting 35 U.S.C. § 312(a)(3)).

“An obviousness determination requires finding that [a POSITA] would have been motivated to combine or modify the teachings in the prior art and would

have had a reasonable expectation of success in doing so.” *Regents of the Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018); *Intelligent Bio-Sys.*, 821 F.3d at 1367-68; *see also, e.g., NJOY, LLC v. JUUL Labs, Inc.*, IPR2024-00536, Paper 17 (PTAB Aug. 12, 2024) (denying institution where petitioner did not show a reasonable expectation of success in combining the asserted references); *Honeywell Int’l Inc. v. DSM IP Assets, B.V.*, IPR2024-00493, Paper 7 (PTAB Aug. 21, 2024) (same).

In requesting *inter partes* review, “the petitioner is master of its complaint.” *SAS Inst. Inc. v. Iancu*, 138 S.Ct. 1348, 1355 (2018). For this reason, the petition must include “a detailed explanation of the significance of the evidence including material facts” and “[h]ow the construed claim is unpatentable.” 37 C.F.R. §§ 42.22(a)(2), 42.104(b)(4). Given the “expedited nature of IPR proceedings, it is of the utmost importance that petitioners ... adhere to the requirement that the initial petition identify with particularity the evidence that supports the grounds for the challenge to each claim.” *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330 (Fed. Cir. 2019) (cleaned up). “[I]f the fact trier of the issue is left uncertain, the party with the burden loses.” *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378-79 (Fed. Cir. 2015).

Hanwha’s Petition asserts three primary grounds of unpatentability (with multiple alternatives) against the Challenged Claims. Pet., 7. Grounds I and III

challenge independent claim 10, which recites “a dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ ” and “a first emitter region having metal impurities formed over the dielectric region.” And, Ground I also challenges dependent claim 16, which recites “a second emitter region having metal impurities formed over the dielectric region.” None of Hanwha’s asserted grounds establish that it would have been obvious to arrive at the claimed “dopant concentration,” as recited by claim 10, nor at the claimed “first emitter region” and “second emitter region,” as recited by claims 10 and 16. For these same reasons, Ground II (which only challenges dependent claim 18) fails because of claim 18’s dependency from claims 10 and 16. Additional flaws are evident in Ground II, as Hanwha fails to show why a POSITA would have been motivated to modify Choi to incorporate the “trench region” of claim 18.

As explained below, Hanwha has not satisfied its burden with respect to *any* of its grounds. So the Board should deny institution.

A. All Grounds: Hanwha fails to show that the prior art combinations teach or suggest the claimed “dopant concentration.”

For Grounds I-III, Hanwha relies on outdated and incompatible solar cell configurations of Granek (EX1010) and Marvin (EX1008) to teach the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$.” EX2001, ¶51. Hanwha ignores Granek’s and Marvin’s teachings of solar cell

structures as a whole and impermissibly cherry-picks their dopant concentration recommendations to arrive at the claimed “dopant concentration.” *Id.* Moreover, Hanwha, fails to show why a POSITA would have been motivated to implement Granek’s or Marvin’s dopant concentrations in Choi or Cousins, in view of optimum dopant concentrations—higher than $2 \times 10^{18} \text{ cm}^{-3}$ —for solar cell configurations compatible with Choi and Cousins, such as Lamers (EX2002), Desa (EX2003), and Procel (EX2005). *Id.* Thus, Hanwha fails to carry its burden to show that the Challenged Claims would have been obvious.

1. Grounds I and II: Hanwha fails to show why a POSITA would have been motivated to combine Choi with Granek or Marvin.

Hanwha fails to meet its burden to show that a POSITA would have been motivated to combine Choi with Granek or Marvin to teach the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$.” In particular, Hanwha fails to show why a POSITA would have been motivated to apply (a) Granek’s three-layer passivation solar cell teachings to Choi’s two-layer passivation solar cell structure and (b) Marvin’s outdated solar cell teachings—with known disadvantages—to Choi’s solar cell structure. EX2001, ¶52.

a. A POSITA would not have applied Granek's three-layer passivation solar cell teachings to Choi's two-layer passivation solar cell structure.

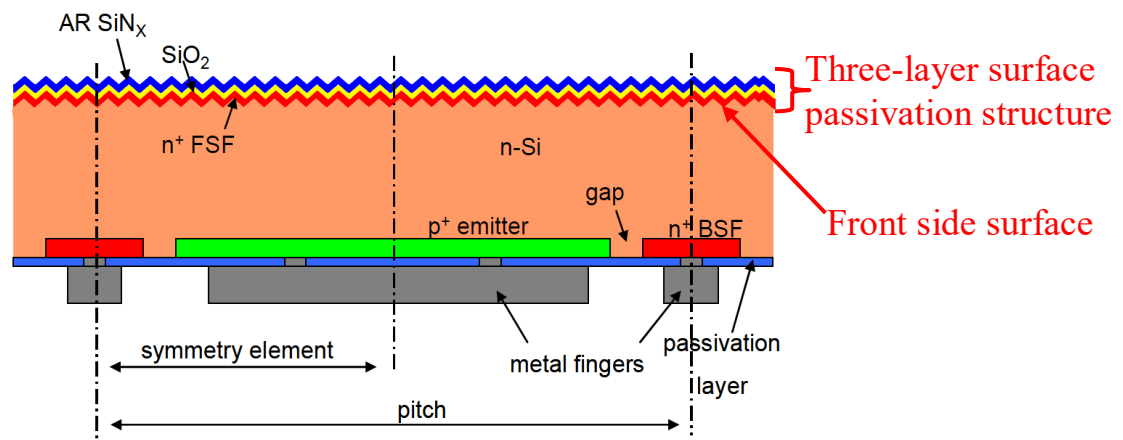
Hanwha argues that “[a] POSITA would have been motivated to use Granek’s ... dopant concentration in Choi’s FSF region.” Pet., 36. But, Hanwha provides no explanation for why a POSITA would have been motivated to look to Granek’s three-layer surface passivation structure—which is structurally different from Choi’s two-layer surface passivation structure—to determine a front surface dopant concentration in Choi. Hanwha ignores these structural differences and wrongly asserts that “Choi [and] Granek ... each teach solar cells with similar structures” and “[a] POSITA would have recognized that the dopant concentrations taught by Granek ... would have equal application to Choi and would have been motivated to use those concentrations to reduce recombination, thereby improving efficiency.” Pet., 38, 40. As explained below, Hanwha’s assertion is solely based on a selective, incorrect reading of Granek’s front surface dopant concentration, while ignoring Granek’s surface passivation structure teachings as a whole. EX2001, ¶53. Further, Hanwha also ignores the teachings of references with similar surface passivation structures as Choi’s, such as Lamers and Desa, that disclose optimum dopant concentrations for highly-efficient solar cells higher than the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$.” *Id.*

- i. **Hanwha ignores the impact of Granek’s stack system of silicon nitride/silicon oxide passivation layers—a structure missing in Choi’s solar cell—on solar cell efficiency.**

Hanwha ignores the surface passivation structure differences between Choi and Granek, when asserting that “a POSITA would have known that fabricating Choi’s cell with Granek’s [] dopant concentrations would have involved a minor adjustment to one fabrication step,” in which “only minor adjustments to the processing parameters of the dopant-diffusion process (such as heating time and temperature) would be required. No other steps would be affected, and no additional steps would be needed.” Pet., 41. Hanwha provides no explanation why a POSITA would have been motivated to adopt *only* Granek’s dopant concentration of the front surface field (FSF) layer—without adopting design parameters of the stack system of SiO₂/SiN_x passivation layers in Granek’s passivation structure—to improve Choi’s solar cell efficiency. EX2001, ¶55. As explained below, Granek demonstrates that its solar cell efficiency depends on *both* the parameters of its FSF layer (e.g., doping profile and dopant concentrations) *and* the parameters of its stack system of SiO₂/SiN_x passivation layers (e.g., thickness). EX1010, 123, 129; EX2001, ¶55.

Granek discloses a solar cell with a three-layer surface passivation structure on its front side surface. EX2001, ¶56. Referring to FIG. 4-1 (reproduced and annotated below), Granek’s three-layer surface passivation structure includes an

anti-reflective (AR) silicon nitride (SiN_x) layer (highlighted blue), a silicon oxide (SiO_2) layer (highlighted yellow), and a front surface field (FSF) layer (highlighted red), for front surface passivation of the front side surface of Granek's solar cell. EX1010, 45-46, 119-120; EX2001, ¶56. Granek explains that its three-layer surface passivation structure "reduce[s] the recombination rate at the [front side] silicon surface" of its solar cell. EX1010, 119. The SiN_x layer and the SiO_2 layer "are applied in the investigated solar cell structure in a form of a stack of passivation layers" to "reduce the density of the surface states" on the front side surface of Granek's solar cell. EX1010, 119. And, the FSF layer is used to "passivate[] the silicon surface by a strong reduction of holes concentration at the surface." EX1010, 45-46, 119.



EX1010, FIG. 4-1 (annotated).

Granek analyzes "the front surface passivation quality of the phosphorus doped [FSF layer] combined with [the] stack system of $\text{SiO}_2/\text{SiN}_x$ passivation layers" to determine the dopant concentration of the FSF layer in correlation to the

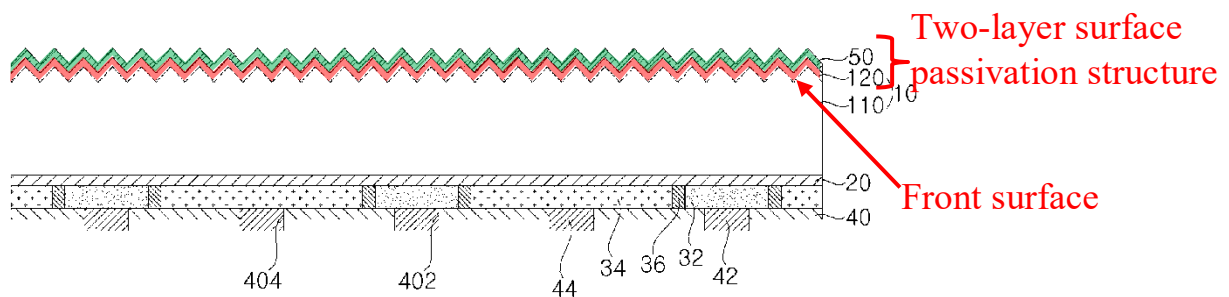
stack system of SiO₂/SiN_x passivation layers for the highest solar efficiency.

EX1010, 119-120; EX2001, ¶57. Granek concludes that “for the poorly passivated surfaces, highly doped and deep diffusion profiles are optimal in order to minimize the surface recombination [], with sheet resistance of about 10 Ω/sq.” EX1010, 123; EX2001, ¶57. Granek also concludes that “[o]n the other hand, for the well passivated surfaces, an optimal diffusion profile is lowly doped and shallow [], with the sheet resistance of around 200 to 800 Ω/sq.” *Id.* Granek further concludes that “a good surface passivation with thin SiO₂ and antireflection SiN_x layers have enabled processing of back-junction back-contact solar cells with efficiencies greater than 21 %” EX1010, 129; EX2001, ¶57.

Unlike Granek, Choi does not disclose a stack system of SiO₂/SiN_x passivation layers on its FSF layer. EX2001, ¶58. Instead, referring to FIG. 1 (reproduced and annotated below), Choi discloses a solar cell 100 with a two-layer surface passivation structure that includes an anti-reflective film 50 (highlighted green) and an FSF layer 120 (highlighted red) on its front surface. EX1006, ¶¶29-30; EX2001, ¶58. To reduce the recombination rate at the front surface of Choi’s solar cell, the FSF layer 120 “prevents electrons and holes separated by incident light from being recombined and then decay on the front surface of the semiconductor substrate 10,” and the anti-reflective film 50 “passivates defects present on the surface or in the bulk of the front surface field layer 120.” EX1006,

¶¶29-30. In addition, the anti-reflective film 50 “removes recombination sites of minority carriers and thus increases open-circuit voltage (Voc) of the solar cell 100.” *Id.*, ¶31. Choi concludes that “the anti-reflective film 50 increases open-circuit voltage and short current of the solar cell 100, thus improving conversion efficiency of the solar cell 100.” *Id.*

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EX1006, FIG. 1 (annotated).

In view of the above structural differences between the surface passivation structures of Choi and Granek and Hanwha’s material omission of the impact of Granek’s stack system of SiO₂/SiN_x passivation layers on solar cell efficiency, Hanwha fails to show why it would have been obvious to a POSITA to modify Choi based on Granek’s teachings. EX2001, ¶59.

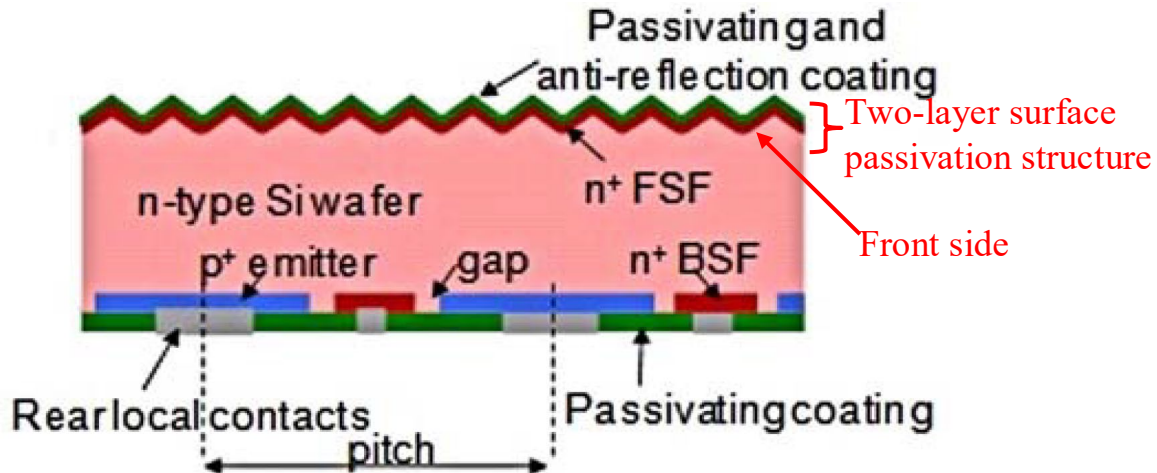
ii. Hanwha fails to consider solar cells with surface passivation structures similar to Choi’s.

Hanwha fails to show why it would have been obvious to a POSITA to modify Choi with Granek, in view of other references with surface passivation structures similar to Choi’s, such as Lamers and Desa, that disclose optimum

dopant concentrations for highly-efficient solar cells higher than the claimed

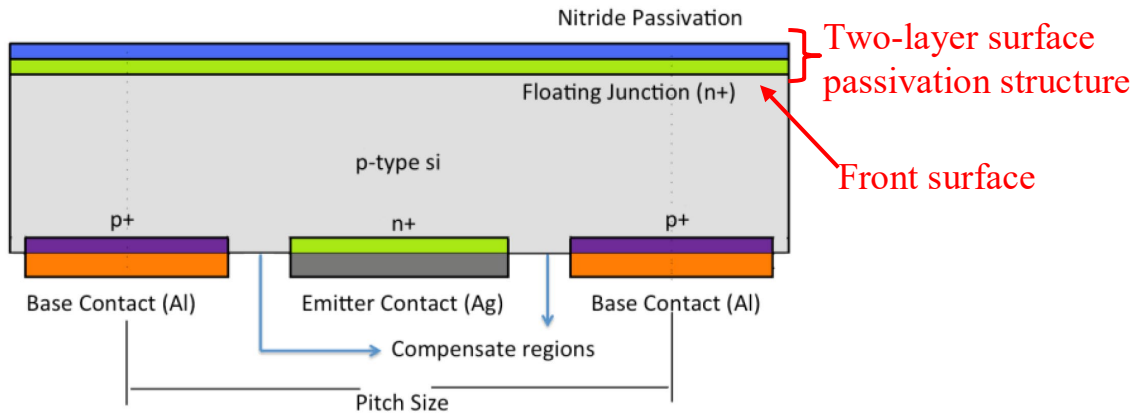
“dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$.”

Referring to FIG. 1 (reproduced and annotated below), Lamers discloses a solar cell with a two-layer surface passivation structure having a passivation/anti-reflection coating (highlighted green) and an FSF layer (highlighted red) on its front surface. Lamers, 1 (“The front side is passivated using SiNx:H coating on top of the FSF.”); EX2001, ¶61. Lamers discloses an optimum dopant concentration of $3 \times 10^{18} \text{ atoms/cm}^2$ for the FSF layer—which is higher than the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ ”—for achieving an optimal short circuit current J_{sc} of the solar cell. Lamers, 2 (“The function of the front surface is to reduce the recombination at the front side and improve lateral transport. Recombination in the FSF should be minimal and the optimal doping level was found to be $3 \cdot 10^{18} \text{ atoms/cm}^2$ It can be seen that the J_{sc} is optimal for dopants at $3 \cdot 10^{18} \text{ atoms/cm}^3$ for a wide variety of S as it shows that for this doping level the processing is most stable in terms of surface passivation.”); EX2001, ¶61. Lamers further discloses solar cell efficiencies above 21 %, which is comparable to Granek’s solar cell efficiency (discussed above). Lamers, 3; EX2001, ¶61. But Lamers reports higher solar cell efficiencies at dopant concentrations higher than the claimed “dopant concentration.”

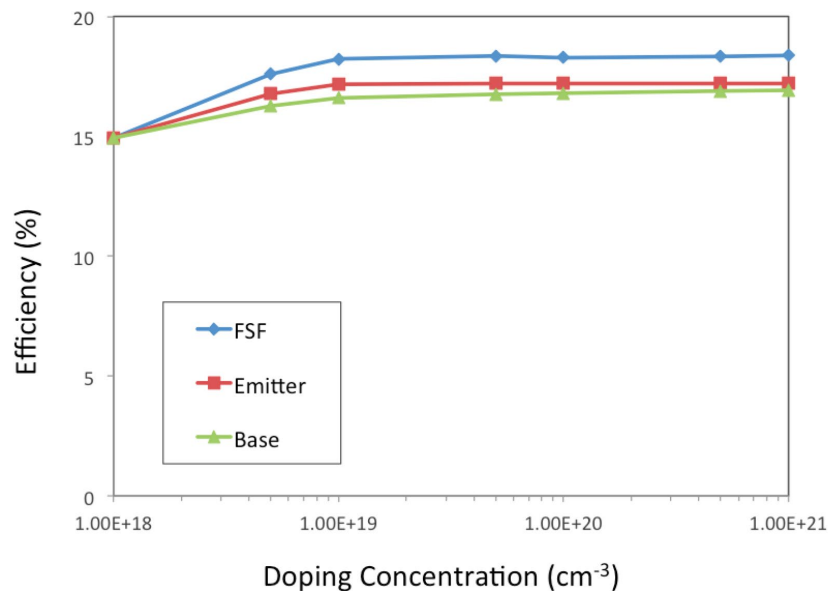


EX2002, FIG. 1 (annotated).

Similarly, referring to FIG. 2 (reproduced and annotated below), Desa discloses a solar cell with a two-layer surface passivation structure having a nitride passivation layer (highlighted blue) and an FSF layer (highlighted green) on its front surface. EX2003, 70 (“The emitter or n⁺ regions and front surface field (FSF) layer (floating junction) were created by phosphorous implantation. ... SiN_x layer was deposited as passivation and anti-reflective coating.”); EX2001, ¶62. Based on this two-layer passivation structure, referring to FIG. 5c below, Desa demonstrates the highest solar cell efficiency achieved for a dopant concentration of 10¹⁹ cm⁻³ in the FSF layer, which is higher than the claimed “dopant concentration of approximately less than or equal to 2×10¹⁸ cm⁻³.” EX2001, ¶62.



EX2003, FIG. 2 (annotated).



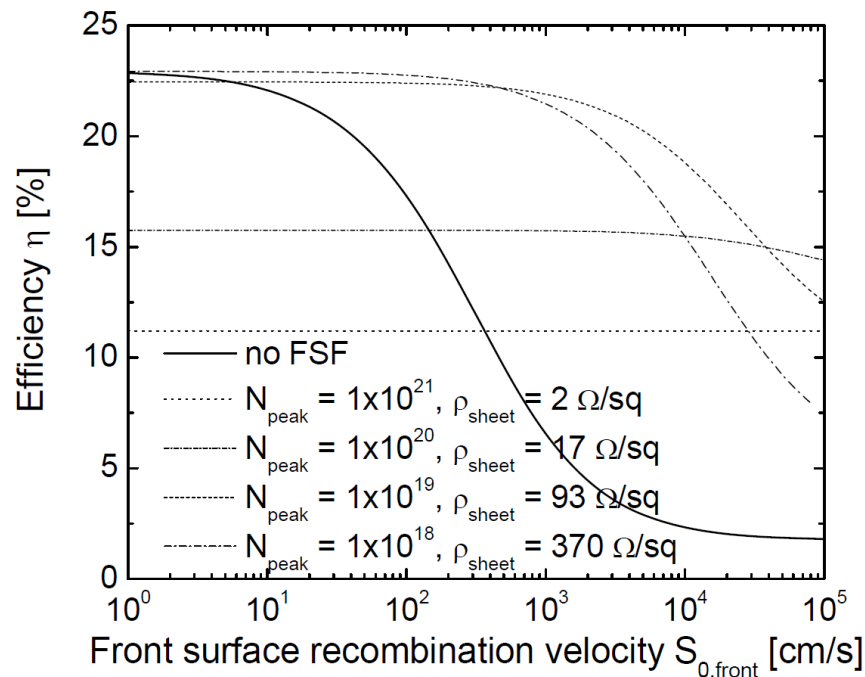
EX2003, FIG. 5c (annotated).

Thus, in view of references with similar surface passivation structures as Choi's (e.g., Lamers and Desa), a POSITA would not have found it obvious to modify Choi based on Granek's teachings, as Hanwha proposes. EX2001, ¶63.

iii. Hanwha misinterprets Granek's disclosure to support its motivation to combine rationale.

Hanwha relies on false conclusory statements to support the alleged benefits of improved solar cell efficiency when combining Choi with Granek. Referring to

FIG. 7-1 below, Hanwha relies on Granek’s simulated highest solar cell efficiency of 23 % for a dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$ of the FSF layer to arrive at the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ ” and to show that a POSITA would have been motivated to combine Choi with Granek to improve efficiency. Pet., 37-38 (“Granek discloses that a back-contact solar cell with an FSF dopant concentration of approximately $1 \times 10^{18} \text{ cm}^{-3}$ achieves the highest efficiency. ... [A POSITA] would have been motivated to use those concentrations to reduce recombination, thereby improving efficiency.”); EX2001, ¶64.



EX1010, FIG. 7-1.

However, throughout its disclosure, Granek never acknowledges the simulated highest solar cell efficiency as the highest efficiency that can be

achieved from its developed solar cells. EX2001, ¶65. Rather, Granek relies on experimental values for the highest solar cell efficiencies when describing optimized solar cell parameters. EX1010, 131 (“The highest efficiency of 20.8 % was achieved on base resistivity of 1 Ω cm and deep diffused FSF (FSF5).”), 175 (“The highest solar cell efficiency of 21.1 % ($J_{SC} = 38.6$ mA/cm², $V_{OC} = 668$ mV, $FF = 82.0$ %) was achieved on 160 μ m thick 1 Ω cm n-type FZ Si with the designated area of 4 cm².”); EX2001, ¶65. Granek reported a highest efficiency of 20.8 % for a solar cell with a dopant concentration of 3.8×10^{18} /cm³ of the FSF layer. EX1010, 131-132. Granek also reported a highest efficiency of 20.8 % for a laboratory-scale (4 cm²) solar cell with a dopant concentration of 5×10^{18} /cm³ of the FSF layer. *Id.*, 46, 70.

Because the dopant concentrations of the FSF layer related to the experimental values of the highest solar cell efficiencies are higher than the claimed “dopant concentration of approximately less than or equal to 2×10^{18} cm⁻³,” Hanwha attempts to reconcile this disparity between the simulated and experimental values by stating that “[a] POSITA would have expected, based on Granek’s experiments, that further decreasing the concentration to approach the simulation result of 1.0×10^{18} /cm³ would have further improved performance.” Pet, 40, n.5. Dr. Holman makes a similar statement: “a person of ordinary skill in the art, looking at both Granek’s simulation results and experimental results in

conjunction, would have expected that a FSF dopant concentration of about $1.0 \times 10^{18} \text{ cm}^{-3}$ would have achieved a higher efficiency.” EX1003, ¶153.

However, Granek itself contradicts Hanwha’s assertions. EX2001, ¶67. Granek discloses that a highest efficiency of 20.8 % was achieved for a solar cell with a dopant concentration of $3.8 \times 10^{18} / \text{cm}^3$ of the FSF layer. EX1010, 131-132. Granek also discloses a laboratory-scale (4 cm^2) solar cell with a dopant concentration of $5 \times 10^{18} / \text{cm}^3$ of the FSF layer, for which a “best conversion efficiency of 21.1 % (designated area measurement) was achieved on $1 \Omega \text{ cm}$ n-type FZ Si with the pitch of $2200 \mu\text{m}$.” *Id.*, 46, 70. Thus, an increase in solar efficiency—from 20.8 % to 21.1 %—was observed with an increase in dopant concentration of the FSF layer, which directly contradicts Hanwha’s and Dr. Holman’s position of decreasing dopant concentration to improve solar cell performance. EX2001, ¶67.

Even if a POSITA would have been motivated to modify Choi with Granek’s dopant concentration of $1 \times 10^{18} / \text{cm}^3$ to achieve the simulated highest solar cell efficiency of 23 % (which they would not be), Hanwha has not sufficiently established that a POSITA would have had a reasonable expectation that the proposed modification would be successful. EX2001, ¶68. Contrary to Hanwha’s assertion that a “POSITA would have had a reasonable expectation of successfully combining Choi with Granek, ... [with] only minor adjustments to the

processing parameters of the dopant-diffusion process,” Granek states otherwise.

Pet. 39, 41. Indeed, Granek explains that “the solar cell efficiencies of up to 23 % could be reached by improving the solar cell optics, reduction of the overall recombination losses, minimization of the electrical shading and optimization of the cell and grid geometry, which is limited by the industrial structuring technologies.” EX1010, 176. Put differently, achieving the simulated highest solar cell efficiency not only depends on the dopant concentration of the FSF layer, but also on other solar cell parameters (e.g., improving solar cell optics, reduction of recombination losses, and minimization of electrical shading). EX2001, ¶68.

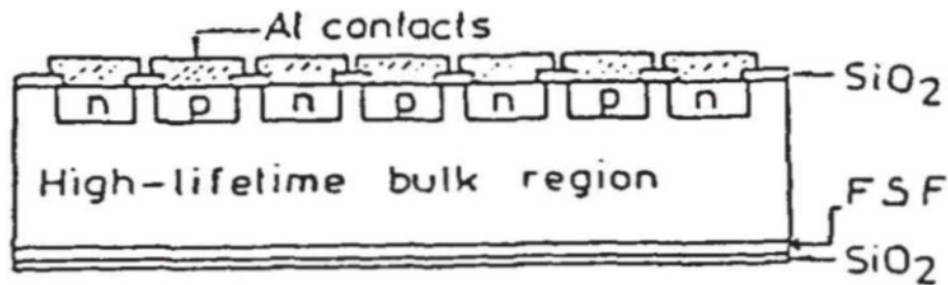
Hanwha does not consider any of these important solar cell parameters and thus fails to establish that a POSITA would have had a reasonable expectation of success of achieving the highest solar cell efficiency if modifying Choi based on Granek’s teachings. *Id.*

b. A POSITA would not have applied Marvin’s outdated solar cell teachings—with known disadvantages—to Choi’s solar cell structure.

Hanwha fails to show why it would have been obvious to a POSITA to modify Choi with the design parameters from Marvin’s outdated solar cell structure, which is known to have reliability issues. *See United States v. Adams*, 383 U.S. 39, 52 (1966) (“[K]nown disadvantages in old devices which would naturally discourage the search for new inventions may be taken into account in

determining obviousness.”).

Referring to FIG. 1 below, Marvin discloses a solar cell with an SiO_2 layer and an FSF layer on its front surface. EX2001, ¶70. Marvin analyzes the efficiency of its solar cell for different dopant concentrations of the FSF layer and different thicknesses of the solar cell. EX1008, 23; EX2001, ¶70. Based on this analysis, Marvin demonstrates a highest solar cell efficiency for a solar cell thickness of 50 μm and a dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$ of the FSF layer, as shown in Table 8 below. EX2001, ¶70. Table 8 demonstrates that increasing the thickness of Marvin’s solar cell decreases the solar cell efficiency for the dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$. EX2001, ¶70.



EX1008, FIG. 1 (excerpted).

Table 8. EOL Efficiency as a Function of cell Thickness and FSF at 100 Suns

Cell Thickness (μm)	Graded FSF (μm)	Step FSF (μm)	FSF Doping cm^{-3}	*Spacing a/b/c	Cell Efficiency (%)
50	15	—	1E18	10/20/10	14.64
50	15	—	1E18	5/10/5	15.44
65	15	—	1E18	5/10/5	11.57
80	15	—	1E18	5/10/5	8.97
200	15	—	5E18	5/10/5	1.18
65	—	0.5	5E18	5/10/5	8.17
80	—	0.5	5E18	5/10/5	6.83

EX1008, Table 8 (annotated).

Hanwha ignores this correlation between Marvin’s solar cell thickness and solar cell efficiency, when asserting that a “POSITA would have recognized that the dopant concentrations taught by ... Marvin would have equal application to Choi and would have been motivated to use those concentrations to reduce recombination, thereby improving efficiency. ... Further, a POSITA would have known that fabricating Choi’s cell with ... Marvin’s dopant concentrations would have involved a minor adjustment to one fabrication step. ... [O]nly minor adjustments to the processing parameters of the dopant-diffusion process (such as heating time and temperature) would be required. No other steps would be affected, and no additional steps would be needed.” Pet., 38, 41. Hanwha provides no explanation why a POSITA would have been motivated to adopt *only* Marvin’s dopant concentration of the FSF layer—while ignoring solar cell thickness—in an attempt to improve Choi’s solar cell efficiency. EX2001, ¶71. Marvin demonstrates

that its solar cell efficiency depends on solar cell thickness, yet Hanwha glosses over this inconvenient fact. EX2001, ¶71.

Based on Marvin's teachings, Choi's solar cell would also need to be modified to have a thickness of 50 μm to achieve the alleged improvement asserted by Hanwha. EX2001, ¶72. But, it was well known that a solar cell fabricated using a "wafer with thickness below 200 μm is fragile and susceptible to cracking during screen printing and handling processes." EX2003, 72; EX2001, ¶72. Since Choi can use screen printing processes for its solar cell fabrication, a POSITA would not have found it obvious to modify Choi's solar cell thickness to achieve Marvin's dopant concentration of the FSF layer because Choi's solar cell would be fragile and susceptible to cracking during fabrication. EX1006, ¶72 ("The insulating layer 40 may be formed by a variety of methods such as vacuum deposition, chemical vapor deposition, spin coating, screen printing or spray coating"); ¶75 ("The anti-reflective film 50 may be formed by a variety of methods such as vacuum deposition, chemical vapor deposition, spin coating, screen printing or spray coating."); EX2001, ¶72. Thus, contrary to Hanwha's assertions, a POSITA would not have been motivated to modify Choi with Marvin's dopant concentration of the FSF layer because such modification would have caused reliability issues. EX2001, ¶73.

2. Ground III: Hanwha fails to show why a POSITA would have been motivated to combine Cousins with Granek or Marvin.

Hanwha also fails to meet its burden to show that a POSITA would have been motivated to combine Cousins with Granek or Marvin to teach the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$.” EX2001, ¶74. In particular, Hanwha fails to show why a POSITA would have been motivated to apply (a) the front surface dopant concentration teaching from Granek’s solar cell structure with a thick passivation layer to Cousins’s solar cell structure with a thinner passivation layer, (b) Marvin’s two-layer passivation solar cell teachings to Cousins’s three-layer passivation solar cell structure, and (c) the front surface dopant concentration from Marvin’s thin solar cell structure—with known disadvantages—to Cousins’s thicker solar cell structure. *Id.*

a. A POSITA would not have applied the front surface dopant concentration teaching from Granek’s solar cell structure with a thick passivation layer to Cousins’s solar cell structure with a thinner passivation layer.

Hanwha argues that “[a] POSITA would have been motivated to use Granek’s ... dopant concentration in Cousins’ doped front portion.” Pet., 68. But, Hanwha provides no explanation why a POSITA would have been motivated to look to Granek’s surface passivation structure—which is structurally different from Cousins’s surface passivation structure—to determine a front surface dopant

concentration in Cousins. Rather, Hanwha ignores the structural differences between Granek's thick surface passivation structure and Cousins's thinner surface passivation structure and wrongly asserts that "[a] POSITA would have recognized that the dopant concentrations taught by Granek ... would have equal application to [Cousins] ... and would have been motivated to use those concentrations to reduce recombination, thereby improving efficiency." *Id.*, 40, 68 (citations referring to Pet., 38). As explained below, Hanwha's assertion is solely based on a selective, incorrect reading of Granek's front surface dopant concentration, while ignoring Granek's surface passivation structure teachings as a whole. EX2001, ¶75. Hanwha also ignores the teachings of references with passivation structures similar to Cousins's—such as Procel—which show that using higher dopant concentrations on the front surface of substrates eliminates the need for a thicker passivation layer, such as Granek's passivation layer. EX2001, ¶75.

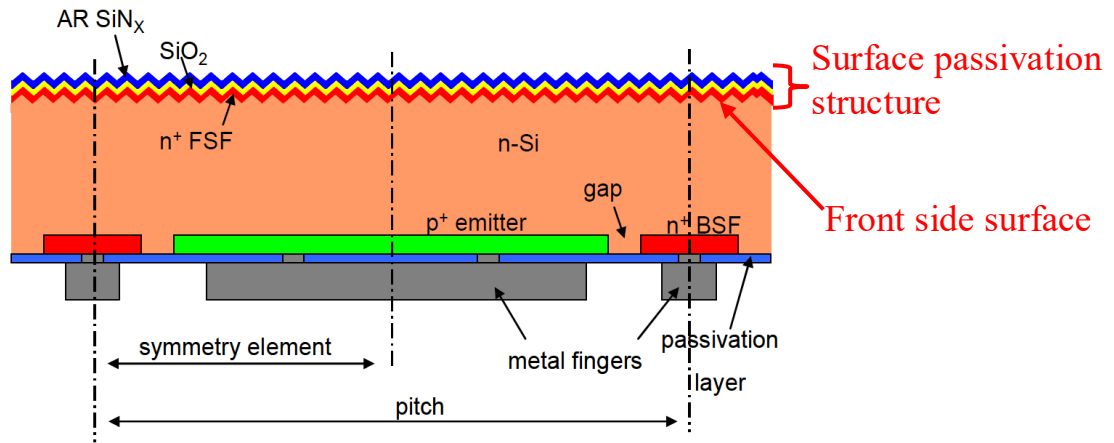
i. Hanwha ignores the impact of the thickness of Granek's stack system of silicon nitride/silicon oxide passivation layers on solar cell efficiency.

Hanwha ignores the surface passivation structure differences between Cousins and Granek, when asserting that a POSITA "would have been motivated to use ... [Cousins's] concentrations to reduce recombination, thereby improving efficiency" and it would involve "a straightforward implementation of a dopant concentration of approximately $1 \times 10^{18} \text{ cm}^{-3}$ in the doped front portion" of Cousins.

Pet., 68 (citations referring to Pet., 38), 69. Hanwha provides no explanation why a POSITA would have been motivated to adopt *only* Granek's dopant concentration of the FSF layer—without adopting the thicknesses of Granek's stack system of SiO₂/SiN_x passivation layers—in an attempt to improve Cousins's solar cell efficiency. EX2001, ¶76. As explained below, Granek demonstrates that its solar cell efficiency depends on *both* the parameters of its FSF layer (e.g., doping profile and dopant concentrations) *and* the parameters of its stack system of SiO₂/SiN_x passivation layers (e.g., thickness). EX1010, 123, 129; EX2001, ¶76.

Granek discloses a solar cell with a surface passivation structure on its front side surface. Referring to FIG. 4-1 (reproduced and annotated below), Granek's surface passivation structure includes a 80 nm – 110 nm thick stack system of SiO₂/SiN_x passivation layers—a 70 nm thick AR SiN_x layer (highlighted blue) and a 10 nm – 40 nm thick SiO₂ layer (highlighted yellow)—and an FSF layer (highlighted red) for front surface passivation of the front side surface of Granek's solar cell. EX1010, 45-46, 55-56, 119-125; EX2001, ¶77. Granek explains that its surface passivation structure “reduce[s] the recombination rate at the [front side] silicon surface” of its solar cell. EX1010, 119. The stack system of SiO₂/SiN_x passivation layers “reduce the density of the surface states” on the front side surface of Granek's solar cell. *Id.*, 119. And, the FSF layer is used to “passivate[] the silicon surface by a strong reduction of holes concentration at the surface.” *Id.*,

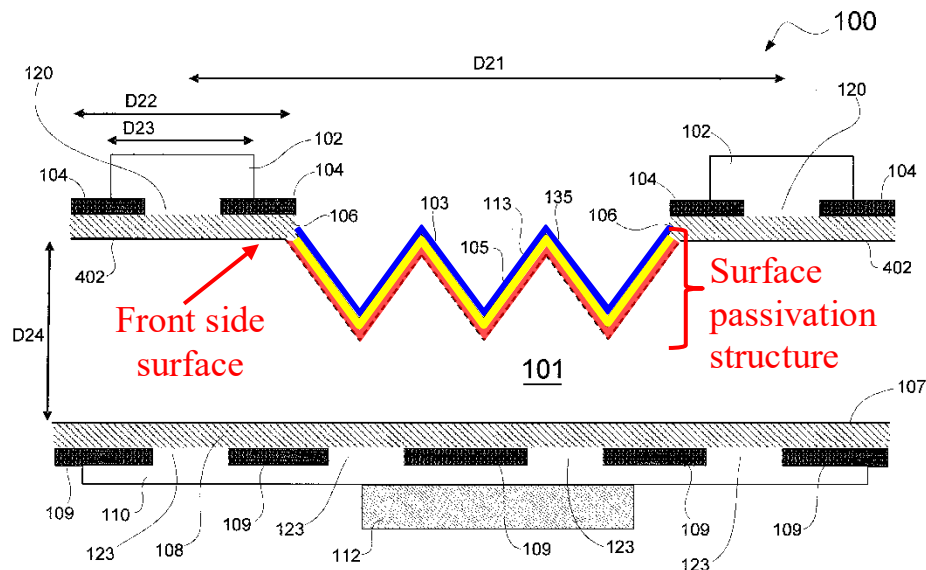
45-46, 119.



EX1010, FIG. 4 -1 (annotated).

Granek analyzes “the front surface passivation quality of the phosphorus doped [FSF layer] combined with [the] stack system of $\text{SiO}_2/\text{SiN}_x$ passivation layers” to determine the dopant concentration of the FSF layer in correlation to the stack system of $\text{SiO}_2/\text{SiN}_x$ passivation layers for the highest solar efficiency. EX1010, 119-120; EX2001, ¶78. Granek concludes that “for the poorly passivated surfaces, highly doped and deep diffusion profiles are optimal in order to minimize the surface recombination [], with sheet resistance of about $10 \, \Omega/\text{sq.}$ ” EX1010, 123. Granek also concludes that “[o]n the other hand, for the well passivated surfaces, an optimal diffusion profile is lowly doped and shallow [], with the sheet resistance of around 200 to $800 \, \Omega/\text{sq.}$ ” *Id.* Granek further concludes that “a good surface passivation with thin SiO_2 and antireflection SiN_x layers [(e.g., 10 nm SiO_2 layer and 70 nm SiN_x layer)] have enabled processing of back-junction back-contact solar cells with efficiencies greater than 21 %” *Id.*, 129.

In contrast, Cousins discloses a solar cell 100 with a surface passivation structure thinner than Granek's. EX2001, ¶79. Referring to FIG. 1 (reproduced and annotated below), Cousins discloses a surface passivation structure that includes a 46 nm – 70 nm thick stack of oxide/nitride passivation layers—a 45 nm thick silicon nitride layer 103 (highlighted blue) and a 1 nm – 25 nm thick passivating oxide 135 (highlighted yellow)—and an n-type doped region 105 (highlighted red) on its front side. EX1007, 2:49-51, 3:3-12, 6:16-17; EX2001, ¶79. The n-type doped region 105 “provides low front surface recombination and improves lateral conductivity whilst not compromising the blue response of the solar cell.” EX1007, 2:54.



EX1007, FIG. 1 (annotated).

In view of the above structural differences between the surface passivation structures of Cousins and Granek, and Hanwha's material omission of the impact

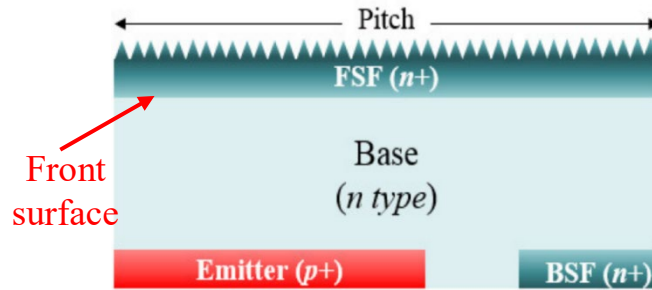
of the thickness of Granek's stack system of SiO₂/SiN_x passivation layers on solar cell efficiency, Hanwha fails to show why it would have been obvious to a POSITA to modify Cousins based on Granek's teachings. EX2001, ¶80.

ii. Hanwha fails to consider solar cells with surface passivation structures similar to Cousins's.

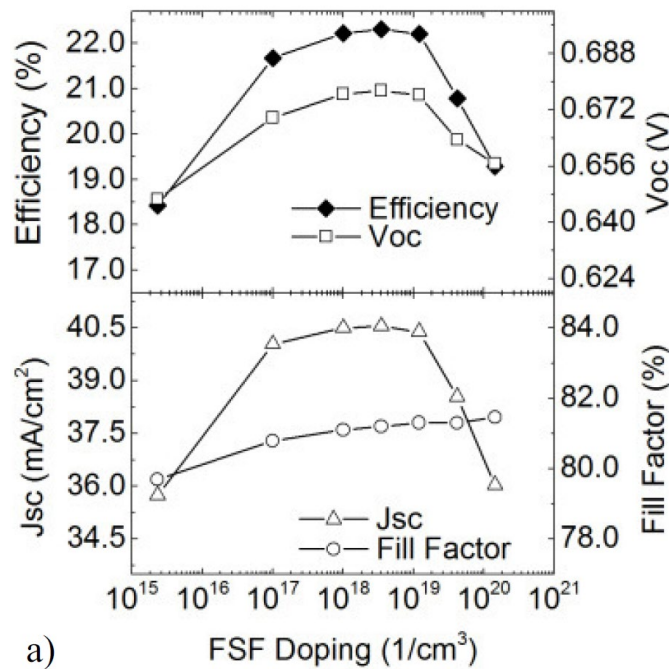
Furthermore, Hanwha fails to show why it would have been obvious to a POSITA to modify Cousins with Granek, in view of other references with surface passivation structures similar to Cousins's, such as Procel, that show optimum dopant concentrations for highly-efficient solar cells that are higher than the claimed "dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$." EX2001, ¶81.

Similar to Cousins, Procel discloses a solar cell with a relatively thinner surface passivation structure. Referring to FIG. 1 (reproduced and annotated below), Procel discloses a surface passivation structure that includes a 69 nm thick stack of SiO₂/Si₃N₄ passivation layers—a 42 nm thick Si₃N₄ layer (not shown in FIG. 1) and a 27 nm thick SiO₂ layer (not shown in FIG. 1)—and an FSF region (highlighted blue in FIG. 1) on its front surface. EX2005, 129 ("1 μm for FSF region. ... The front surface is coated by double-layer Anti-Reflective Coating (ARC) composed by 42nm Si₃N₄ and 27nm SiO₂, ... while the back side is passivated by a 0.1 μm of SiO₂."); EX2001, ¶82. Procel further discloses that "the optimum values of peak doping are: ... $3.47 \times 10^{18} \text{ cm}^{-3}$ for FSF" region and the

solar cell efficiency for this peak doping is greater than 22 % as shown in FIG. 4a below. EX2005, 132; EX2001, ¶82.



EX2005, FIG. 1.



EX2005, FIG. 4a.

Thus, a POSITA would have understood that Procel demonstrates achieving high solar cell efficiency with thin passivation layers, which would require less processing time and lower manufacturing costs than required for manufacturing Granek's solar cells with thicker passivation layers. EX2001, ¶83. Accordingly, a POSITA would not have found it obvious to modify Cousins's n-type doped region

105 with Granek's FSF dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$, as Hanwha asserts.

Pet., 69.

b. A POSITA would not have applied Marvin's two-layer passivation solar cell teachings to Cousins's three-layer passivation solar cell structure.

Hanwha argues that “[a] POSITA would have been motivated to use [] Marvin's ... dopant concentration in Cousins's doped front portion.” Pet., 68. But, Hanwha provides no explanation why a POSITA would have been motivated to look to Marvin's two-layer surface passivation structure—which is structurally different from Cousins's three-layer surface passivation structure—to determine a front surface dopant concentration in Cousins. Hanwha ignores these structural differences and wrongly asserts that “[a] POSITA ... would have been motivated to use [Marvin's FSF dopant] concentrations to reduce recombination, thereby improving efficiency.” *Id.*, 68 (citations referring to Pet., 38); EX2001, ¶84. As explained below, Hanwha fails to show why it would have been obvious to a POSITA to adopt Marvin's FSF dopant concentration for improving solar cell efficiency. Hanwha also ignores the teachings of references with similar surface passivation structures as Cousins's, such as Procel, that disclose higher dopant concentrations and higher solar cell efficiencies than Marvin's. EX2001, ¶84.

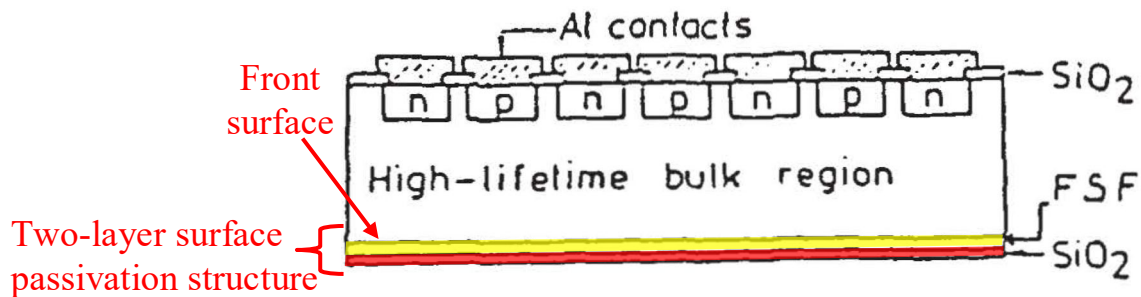
Referring to FIG. 1 (reproduced and annotated below), Marvin discloses a solar cell with a two-layer surface passivation structure having an SiO₂ layer

(highlighted yellow) and an FSF layer (highlighted red) on its front surface.

EX2001, ¶85. Marvin analyzes the solar cell efficiency of its solar cell for different dopant concentrations of the FSF layer and different thicknesses of the solar cell.

EX1008, 23. Based on this analysis, Marvin demonstrates a highest solar cell efficiency of 15.44 % for a solar cell thickness of 50 μm and a dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$ of the FSF layer, as shown in Table 8 below.

EX2001, ¶85.



EX1008, FIG. 1 (annotated, excerpted).

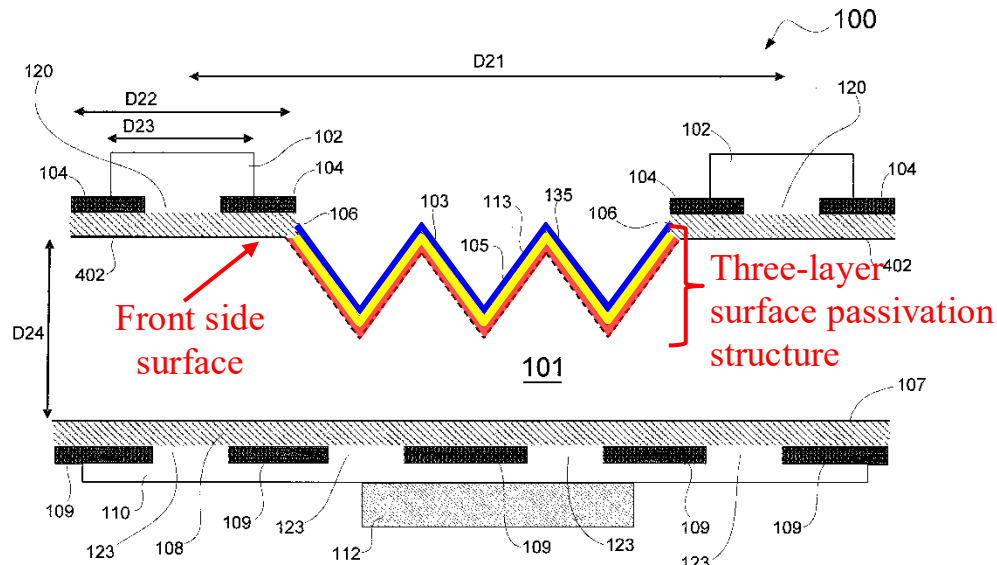
Table 8. EOL Efficiency as a Function of cell Thickness and FSF at 100 Suns

Cell Thickness (μm)	Graded FSF (μm)	Step FSF (μm)	FSF Doping cm^{-3}	*Spacing a/b/c	Cell Efficiency (%)
50	15	—	1E18	10/20/10	14.64
50	15	—	1E18	5/10/5	15.44
65	15	—	1E18	5/10/5	11.57
80	15	—	1E18	5/10/5	8.97
200	15	—	5E18	5/10/5	1.18
65	—	0.5	5E18	5/10/5	8.17
80	—	0.5	5E18	5/10/5	6.83

EX1008, Table 8 (annotated).

In contrast, Cousins discloses a solar cell 100 with a three-layer surface

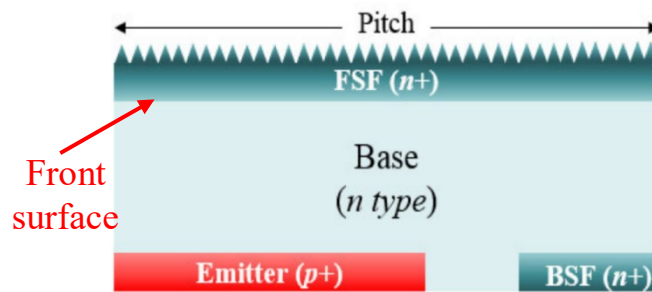
passivation structure. Referring to FIG. 1 (reproduced and annotated below), Cousins's three-layer surface passivation structure includes a silicon nitride layer 103 (highlighted blue), a passivating oxide 135 (highlighted yellow), and an n-type doped region 105 (highlighted red) on its front surface. EX1007, 2:49-51, 3:3-12, 6:16-17; EX2001, ¶86. The n-type doped region 105 "provides low front surface recombination and improves lateral conductivity whilst not compromising the blue response of the solar cell." EX1007, 2:51-54.



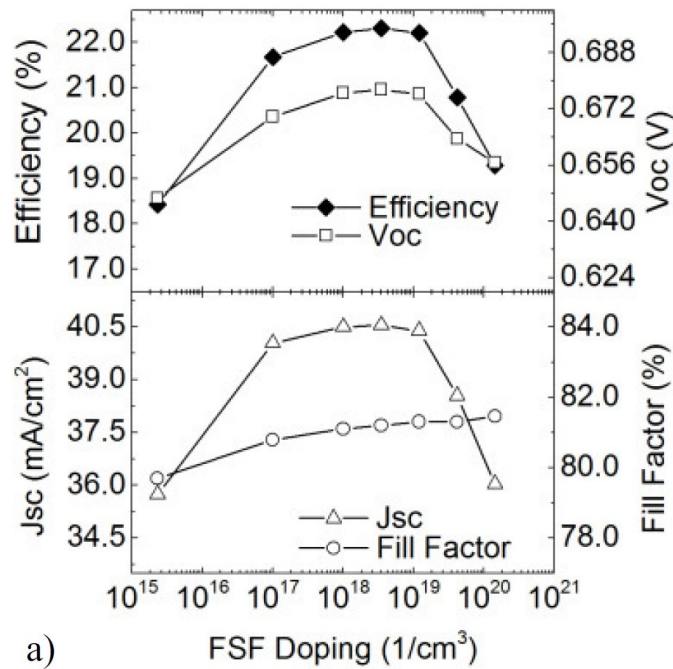
EX1007, FIG. 1 (annotated).

Similar to Cousins, Procel discloses a solar cell with a three-layer surface passivation structure. Referring to FIG. 1 (reproduced and annotated below), Procel's three-layer surface passivation structure includes an Si_3N_4 layer (not shown in FIG. 1), an SiO_2 layer (not shown in FIG. 1), and an FSF region (highlighted blue in FIG. 1) on its front surface. EX2005, 129 ("1 μm for FSF

region. ... The front surface is coated by double-layer Anti-Reflective Coating (ARC) composed by 42nm Si_3N_4 and 27nm SiO_2 , ... while the back side is passivated by a 0.1 μm of SiO_2 ."); EX2001, ¶87. Procel further discloses that "the optimum values of peak doping are: ... $3.47 \times 10^{18} \text{ cm}^{-3}$ for FSF" region and the solar cell efficiency for this peak doping is greater than 22 % as shown in FIG. 4a below. EX2005, 132; EX2001, ¶87.



EX2005, FIG. 1 (annotated).



EX2005, FIG. 4a.

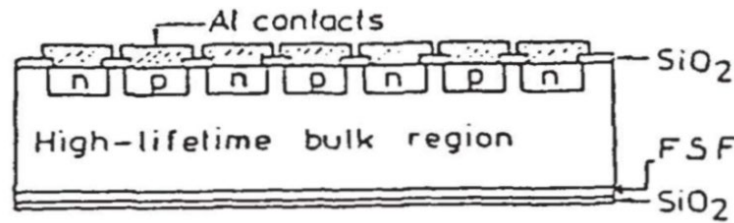
In view of the above structural differences between the surface passivation structures of Cousins and Marvin, a POSITA would not have found it obvious to modify Cousins based on Marvin. EX2001, ¶88. This is because Marvin discloses a much lower solar cell efficiency (15.44 %) than solar cells with similar surface passivation structures as Cousins, such as Procel's solar cell (having an efficiency greater than 22 %). EX2001, ¶88. Thus, Hanwha fails to meet its burden to show that a POSITA would have been motivated to combine Cousins with Marvin to teach or suggest the claimed "dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$."

- c. **A POSITA would not have applied the front surface dopant concentration from Marvin's thin solar cell structure—with known disadvantages—to Cousins's thicker solar cell structure.**

Additionally, Hanwha fails to show why it would have been obvious to a POSITA to modify Cousins with the design parameters from Marvin's outdated solar cell structure, which is known to have reliability issues. *See United States v. Adams*, 383 U.S. 39, 52 (1966) ("[K]nown disadvantages in old devices which would naturally discourage the search for new inventions may be taken into account in determining obviousness.").

Referring to FIG. 1 below, Marvin discloses a solar cell with an SiO₂ layer and an FSF layer on its front surface. Marvin analyzes the solar cell efficiency of its solar cell for different dopant concentrations of the FSF layer and different

thicknesses of the solar cell. EX1008, 23. Based on this analysis, Marvin demonstrates a highest solar cell efficiency for a solar cell thickness of 50 μm and a dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$ of the FSF layer, as shown in Table 8 below. Table 8 demonstrates that increasing the thickness of Marvin's solar cell decreases the solar cell efficiency for the dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$. EX2001, ¶90.



EX1008, FIG. 1 (excerpted).

Table 8. EOL Efficiency as a Function of cell Thickness and FSF at 100 Suns

Cell Thickness (μm)	Graded FSF (μm)	Step FSF (μm)	FSF Doping cm^{-3}	*Spacing a/b/c	Cell Efficiency (%)
50	15	—	1E18	10/20/10	14.64
50	15	—	1E18	5/10/5	15.44
65	15	—	1E18	5/10/5	11.57
80	15	—	1E18	5/10/5	8.97
200	15	—	5E18	5/10/5	1.18
65	—	0.5	5E18	5/10/5	8.17
80	—	0.5	5E18	5/10/5	6.83

EX1008, Table 8 (annotated).

Hanwha ignores this correlation between Marvin's solar cell thickness and its solar cell efficiency, when Hanwha asserts that a POSITA "would have been motivated to use ... [Marvin's] concentrations to reduce recombination, thereby improving efficiency." Pet., 68 (citations referring to Pet., 38). And, it would

involve “a straightforward implementation of a dopant concentration of approximately $1 \times 10^{18} \text{ cm}^{-3}$ in the doped front portion” of Cousins. *Id.*, 69. Hanwha provides no explanation why a POSITA would have been motivated to adopt *only* Marvin’s dopant concentration of the FSF layer—while ignoring solar cell thickness—to improve Cousins’s solar cell efficiency. EX2001, ¶91. Marvin demonstrates that its solar cell efficiency depends on solar cell thickness, a fact Hanwha ignores with its hindsight combination. EX2001, ¶91.

Based on Marvin’s teachings, Cousins’s solar cell would also need to be modified to have a thickness of 50 μm to achieve the alleged improvement asserted by Hanwha. EX2001, ¶92. But, it was well known that a solar cell fabricated using a “wafer with thickness below 200 μm is fragile and susceptible to cracking during screen printing and handling processes.” EX2003, 72; EX2001, ¶92. Since Cousins uses screen printing processes for its solar cell fabrication, a POSITA would not have found it obvious to modify Cousins’s solar cell thickness to achieve Marvin’s dopant concentration of the FSF layer because Cousins’s solar cell would be fragile and susceptible to cracking during fabrication. EX1007, 6:40-42 (“The metal contact 110 may be formed using a printing process, such as screen printing.”); EX2001, ¶92. Thus, contrary to Hanwha’s assertions, a POSITA would not have been motivated to modify Cousins with Marvin’s dopant concentration of the FSF layer because such modification would have caused reliability issues.

EX2001, ¶93.

B. All Grounds: Hanwha fails to show that the prior art combinations teach or suggest the claimed “first emitter region having metal impurities” and “second emitter region having metal impurities.”

For Grounds I-III, Hanwha relies on Istratov (EX1012) to teach the claimed “first emitter region having metal impurities” (independent claim 10) and “second emitter region having metal impurities” (dependent claim 16). EX2001, ¶94. In its Choi-Istratov-based combination (Grounds I and II), Hanwha relies on impermissible hindsight for the proposed combination and fails to consider how the proposed combination would change Choi’s principle of operation. *Id.* Similarly, in its Cousins-Istratov-based combination (Ground III), Hanwha likewise relies on impermissible hindsight for the proposed combination and fails to consider how the proposed combination would degrade Cousins’s solar cell performance. *Id.* Thus, Hanwha fails to carry its burden to show that the Challenged Claims would have been obvious.

1. Grounds I and II: Hanwha fails to show why a POSITA would have been motivated to combine Choi with Istratov.

Hanwha fails to show how it would have been obvious to a POSITA to modify Choi with Istratov without impermissible hindsight bias or changing Choi’s principle of operation. Hanwha argues that “a POSITA would have been motivated to add Istratov’s gettering process ... in Choi’s similar structure to reduce

recombination, thus improving efficiency.” Pet., 43, 45. Hanwha further argues that “Choi teaches a thermal-treatment step during doping of the first and second conductive type areas” and that “[a] POSITA would have recognized that this step would have been used to getter metals from the substrate to the first and second conductive type areas, through heating the cell to a sufficiently high temperature.” *Id.*, 45-46. But Hanwha’s argument fails for at least three reasons.

First, Hanwha fails to articulate which of Istratov’s gettering processes would be used in Choi’s solar cell fabrication process. 35 U.S.C. § 312(a)(3) (A petition for *inter partes* review must “identif[y], in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.”) Hanwha acknowledges Istratov’s different processes for gettering different impurities and states that “[f]or iron, Istratov teaches that heating for “8 h[ours]” “at 1020°C” was “sufficient to equilibrate the iron through the SiO₂ layer” and “[f]or copper, Istratov teaches that heating ‘at 690 °C for 5 h[ours]’ and ‘at 1150 °C for 2h[ours]’ resulted in copper diffusion from the silicon substrate to the polysilicon layer.” Pet., 46. But, Hanwha fails to articulate which of Istratov’s gettering processes and process conditions would be used “during doping of the first and second conductive type areas” in Choi. *Id.*, 45. Instead, Hanwha broadly states that “a POSITA would have used Istratov’s instructions or merely selected a

higher temperature and heated the cell for enough time to induce gettering.” *Id.*,
46.

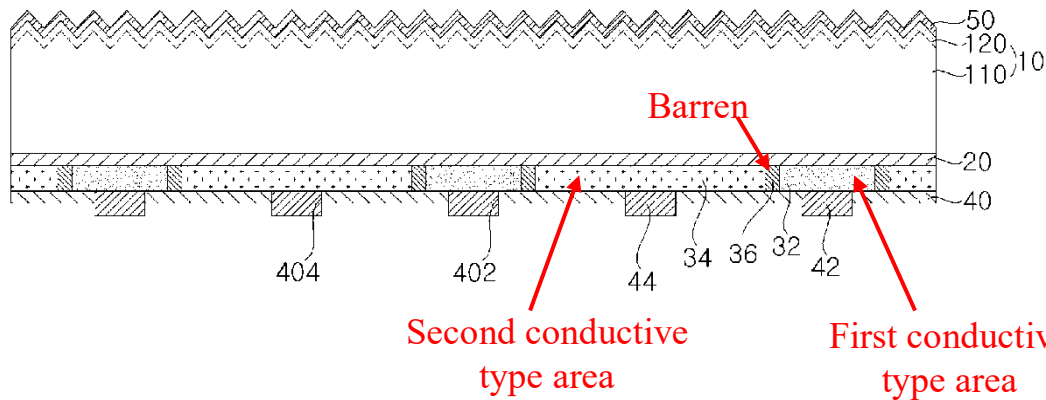
Dr. Holman provides no clarity. Instead, Dr. Holman broadly comments that “[a] person of ordinary skill in the art would have known that [Choi’s] thermal treatment step would have been used to getter metals from the substrate to the first and second conductive type areas by simply heating the solar cell to a high enough temperature. To the extent that an existing processing temperature was not high enough or an existing heating time was not long enough, a person of ordinary skill in the art would merely have had to increase the temperature of the tube furnace that the solar cell was heated in or the heating time to cause gettering.” EX1003, ¶211. Thus, it is unclear from Hanwha’s proposed Choi-Istratov-based combination which of Istratov’s gettering processes (or both) that Hanwha proposes to implement in Choi to teach the claimed “first emitter region having metal impurities” and “second emitter region having metal impurities.” EX2001, ¶¶96-97.

Second, Hanwha fails to show why a POSITA would have been motivated to look to Istratov’s gettering processes for iron and copper impurities in a silicon substrate, in view of Choi’s lack of disclosure of any metal impurities in its monocrystalline silicon substrate. *Id.*, ¶98. Because Istratov discloses different process conditions for gettering iron and copper impurities from the silicon

substrate to a polysilicon layer, a POSITA would not have known which of Istratov's gettering process conditions to implement in Choi without having knowledge of the type of impurities, if any, present in Choi's monocrystalline silicon substrate. *Id.* Thus, without the benefit of impermissible hindsight bias, it would not have been obvious to a POSITA to modify Choi based on Istratov's teachings, as Hanwha proposes. *Id.*

Third, Hanwha fails to show how Istratov's high-temperature gettering processes could be used in Choi without changing Choi's principle of operation. It is well established that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *See In re Ratti*, 270 F.2d 810, 123 USPQ 349 (C.C.P.A. 1959). Nor can it render the art in the combination inoperable for its intended purpose. *See DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1326 (Fed. Cir. 2009); *see also In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). Here, in particular, Hanwha provides no explanation on how using Istratov's high-temperature gettering process conditions during doping of Choi's first and second conductive type areas 32 and 34, as proposed by Hanwha, would prevent an undesirable short between Choi's first and second conductive type areas 32 and 34, which would cause Choi's solar cell to be inoperable.

Referring to FIG. 1 (reproduced and annotated below), Choi discloses a solar cell 100 with a barren area 36, which is “an undoped insulating material (for example, oxide or nitride) or the like” or “amorphous silicon, microcrystalline silicon or polycrystalline silicon,” and is “interposed between the first conductive type dopant 32 and the second conductive type area 34.” EX1006, ¶¶38-39. Choi further discloses that, “[a]s a result [of the barren area 36], shunt caused by undesired short between the first conductive type area 32 and the second conductive type area 34 can be prevented.” *Id.*, ¶56. From this disclosure, a POSITA would have understood that, for Choi’s solar cell to function properly, the barren area 36 needs to remain undoped and electrically non-conductive between the first conductive type area 32 and the second conductive type area 34 to prevent an undesirable short between the two conductive areas. EX2001, ¶¶100-101. However, because Istratov’s high-temperature gettering process during doping of Choi’s first and second conductive type areas 32 and 34 would diffuse dopants from the first and second conductive type areas 32 and 34 into the undoped barrier area 36, an undesirable short between the first conductive type area 32 and the second conductive type area would occur. *Id.* This undesirable short compromises the insulating function of the barren area 36, thus impermissibly changing the principle of operation of Choi’s solar cell 100. *Id.*



EX1006, FIG. 1 (annotated).

Thus, for at least the above reasons, Hanwha fails to sufficiently explain why a POSITA would have been motivated to modify Choi based on Istratov's teachings.

2. Ground III: Hanwha fails to show why a POSITA would have been motivated to combine Cousins with Istratov.

Hanwha also fails to show how it would have been obvious to a POSITA to modify Cousins with Istratov without impermissible hindsight bias or degrading Cousins's solar cell performance. Hanwha argues that "[a] POSITA would have [] been motivated to add Istratov's gettering process" in Cousins because the "back area of the cell in Cousins is readily modifiable using Istratov's gettering into the polysilicon region." Pet., 70-71. But Hanwha's argument fails for at least three reasons.

First, Hanwha fails to articulate which of Istratov's gettering processes would be used in Cousins and how these gettering processes would be implemented in Cousins's solar cell fabrication process. Hanwha only states that

“back area of the cell in Cousins is readily modifiable using Istratov’s gettering into the polysilicon region. ... Cousins’ cell structure (like Choi’s) includes a substrate and an emitter region (‘polysilicon layer 108’) into which metal impurities from the substrate would be gettered using the Istratov process to getter impurities into a polysilicon layer of the solar cell.” *Id.*, 71. Dr. Holman provides similar conclusory statements. EX1003, ¶¶371, 373. Thus, it is unclear from Hanwha’s proposed Cousins-Istratov-based combination which of Istratov’s gettering processes (or both) is being implemented in Cousins to teach the claimed “first emitter region having metal impurities.” EX2001, ¶104.

Second, Hanwha fails to show why a POSITA would have been motivated to look to Istratov’s gettering processes for iron and copper impurities in a silicon substrate, in view of Cousins’s lack of disclosure of any metal impurities in its silicon substrate. EX2001, ¶105. Because Istratov discloses different process conditions for gettering iron and copper impurities from the silicon substrate to a polysilicon layer, without the benefit of impermissible hindsight bias, it would not have been obvious to a POSITA to implement Istratov’s gettering process conditions in Cousins without having knowledge of the type of impurities, if any, present in Cousins’s silicon substrate. *Id.*

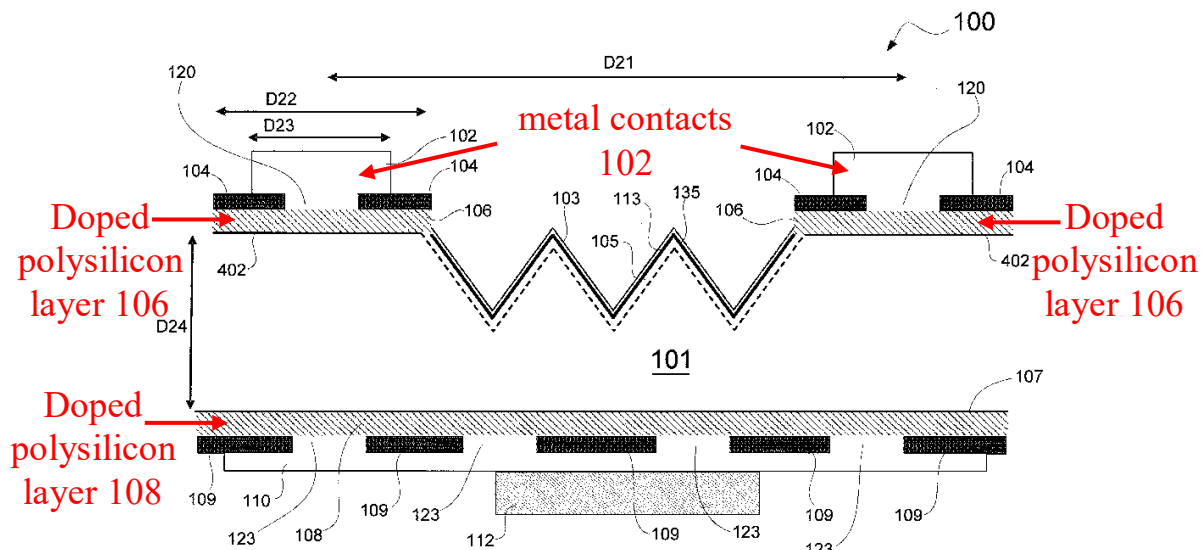
Third, Hanwha fails to show how Istratov’s high-temperature gettering processes could be used in Cousins without degrading solar cell performance. In

particular, Hanwha provides no explanation on how using Istratov's high-temperature gettering process conditions would not adversely affect contact resistance between Cousins's metal contacts 102 and substrate 101. EX2001, ¶106.

Referring to FIG. 1 (reproduced and annotated below), Cousins discloses a solar cell 100 with "a front side where metal contacts 102 are located.... [E]ach metal contact 102 electrically connects to the [doped] polysilicon layer 106 through a contact hole 120 formed through the silicon dioxide layer 104." EX1007, 2:31-32, 3:47-50. Cousins further discloses that "the metal contacts 102 are formed on the silicon dioxide layer 104 to fill the contact holes 120 and make electrical connection to the substrate 101 by way of the [doped] polysilicon layer 106 [, which] ... provides low contact resistance and minimizes contact recombination" between the metal contacts 102 and the substrate 101. *Id.*, 2:56-58, 6:51-54. Cousins also discloses that "[t]he polysilicon layer 106 may be formed on a thin dielectric layer 402," where "[t]he thin dielectric layer 402 may comprise silicon dioxide thermally grown to a thickness of about 10 to 50 Angstroms on the front side surface of the substrate 101." *Id.*, 2:63-64.

From this disclosure, a POSITA would have understood that front side passivating contacts with the doped polysilicon layer 106 and thin silicon dioxide layer 402 between the metal contacts 102 and the silicon substrate 101 are formed in Cousins to minimize recombination losses and contact resistance at the metal

contacts 102. EX2001, ¶¶107-108. It was known that exposing the doped polysilicon layer in passivating contacts to high temperatures over 800 °C causes dopants to diffuse out of the doped polysilicon layer and into the substrate, which increases recombination losses and degrades the passivating quality of the passivating contacts. *Id.* Thus, a POSITA would have understood that implementing Istratov's high-temperature gettering process (e.g., gettering process for iron at 1020 °C, gettering process for copper at 690 °C and at 1150 °C, discussed above) in Cousins would cause dopants to diffuse out of Cousins's doped polysilicon layer 106 and into the substrate 101, undesirably increasing recombination losses at the metal contacts 102 and degrading Cousins's solar cell performance. *Id.*



EX1007, FIG. 1 (annotated).

Thus, for at least the above reasons, Hanwha fails to sufficiently explain why a POSITA would have been motivated to modify Cousins based on Istratov's

teachings.

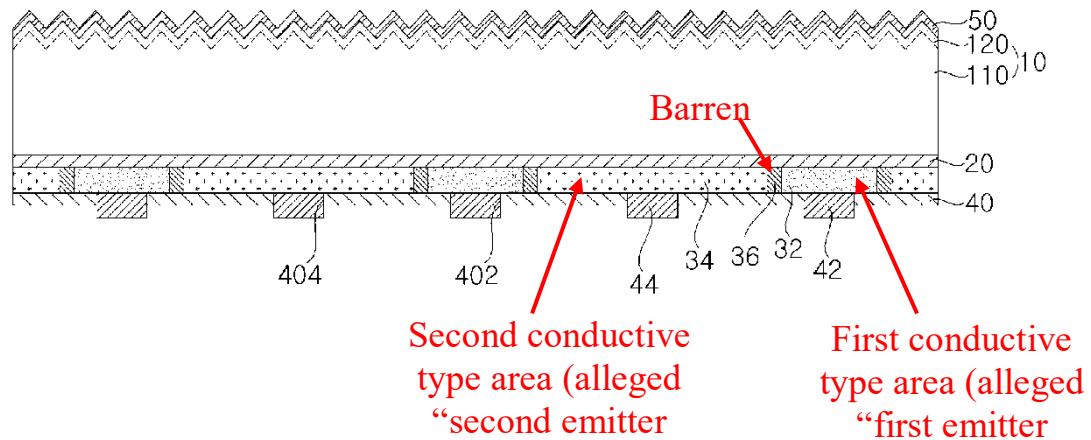
C. Ground II: Hanwha fails to show why a POSITA would have been motivated to modify Choi’s solar cell to incorporate the claimed “trench region”—despite Choi’s teachings to the contrary.

As explained above, Hanwha has not satisfied its burden with respect to *any* of its grounds. Sections IV.A-B. For the same reasons, Ground II (which only challenges dependent claim 18) also fails because of claim 18’s dependency from claims 10 and 16. Sections IV.A.1 and IV.B.1. Additional flaws are evident in Ground II, as Hanwha fails to show why a POSITA would have been motivated to modify Choi to incorporate the claimed “trench region” of claim 18.

In particular, Hanwha fails to articulate why it would have been obvious to a POSITA to modify Choi with Smith’s trench. Hanwha argues that “[a] POSITA would have found it obvious to use a trench, as taught by Smith, to isolate the P-type and N-type emitter regions” in Choi. Pet., 63. To support this obviousness argument, Hanwha states that “[a] POSITA would have been motivated to implement [in Choi’s solar cell]... a trench as taught by Smith to improve efficiency [because] ... directly abutting p-type and n-type doped regions adversely affect efficiency.” *Id.*, 63. But Hanwha’s argument fails for at least three reasons.

First, Hanwha provides no explanation why a POSITA would have been motivated to implement Smith’s trench in Choi, in view Choi’s solar cell that

already includes a barren area 36 to perform the same function for achieving the same alleged benefits as Smith's trench. In particular, referring to FIG. 1 (reproduced and annotated below), Choi discloses a solar cell 100 including "a first conductive type area 32 having a first conductive type dopant [(e.g., p-type)], a second conductive type area 34 having a second conductive type dopant [(e.g., n-type)], and a barrier area 36 formed between the first conductive type area 32 and the second conductive type area 34 are formed on the tunneling layer 20. ... [T]he barrier area 36 may include a variety of materials for substantially insulating the first conductive type area 32 from the second conductive type area 34 ... [and] surrounds the first conductive type area 32 to separate the first conductive type area 32 from the second conductive type area 34 and thereby prevents generation of undesired shunt." EX1006, ¶¶26, 35, 39, 51. In other words, Choi's barren area 36 electrically isolates Choi's p-type doped region 32 from n-type doped region 34, thus performing the same alleged function as Smith's trench. EX2001, ¶111. Hanwha does not address any teachings of Choi's barren area 36, much less why a POSITA would have been motivated to modify Choi with another structure (e.g., Smith's trench) that serves the same function as the barren area 36.



EX1006, FIG. 1 (annotated).

Second, Hanwha provides no explanation why a POSITA would have been motivated to modify Choi with Smith’s trench, in view of Choi’s contradictory teaching from such modification. In particular, Choi discloses that “[u]nlike the present embodiment [with the barren area 36], when the first and second conductive type areas [32 and 34] are separated by etching portions [(e.g., forming a trench)] between the first and second conductive type areas, a portion of the semiconductor substrate is etched and is thus exposed to the outside. As a result, the semiconductor substrate is damaged and properties of solar cell are deteriorated.” EX1006, ¶79. Choi further discloses that “[i]n order to prevent these problems, an additional passivation layer should be formed in a portion of the semiconductor substrate exposed to the outside. As a result, qualities and production efficiency of solar cells are deteriorated.” *Id.*, ¶79; EX2001, ¶112. In other words, rather than form a trench to separate the first and second conductive type areas, Choi discloses forming an additional passivation layer in the substrate

to prevent solar cell damage and deterioration. EX2001, ¶112. Hanwha fails to address this explicit teaching that would have discouraged a POSITA from forming a trench in Choi's solar cell structure.

Third, Hanwha provides no explanation why a POSITA would have been motivated to modify Choi with Smith's trench, which would add additional steps to Choi's solar cell fabrication process. Complicating Choi's manufacturing method—by increasing the number of steps in Choi's solar cell fabrication process—directly contradicts Choi's express objective of “simplifying manufacturing method of the solar cell 100 and improving production efficiency.” EX1006, ¶78; EX2001, ¶113.

Thus, for at least the above reasons, Hanwha fails to sufficiently explain why a POSITA would have been motivated to modify Choi in view of Smith's teachings.

V. THE BOARD SHOULD EXERCISE ITS DISCRETION TO DENY INSTITUTION UNDER § 314(A) AND *FINTIV*.

Under 35 U.S.C. § 314(a), the Director has discretion to deny institution. In determining whether to exercise that discretion on behalf of the Director, the PTAB considers the status of parallel litigation. *NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 (PTAB Sept. 12, 2018). The '315 patent is involved in three concurrent, on-going parallel district court actions in the United States District Court for the Eastern District of Texas:

- *Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.*, No. 2:24-CV-00210-JRG (E.D. Tex. Mar. 25, 2024);
- *Maxeon Solar Pte. Ltd. v. Hanwha Solutions Corp. et al.*, No. 2:24-CV-00262 (E.D. Tex. Apr. 19, 2024); and
- *Maxeon Solar Pte. Ltd. v. REC Solar Holdings AS*, No. 2:24-CV-00260 (E.D. Tex. Apr. 19, 2024).

The Board considers six non-exclusive factors in making its determination. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 6 (PTAB Mar. 20, 2020) (precedential). Balancing these six factors (the “*Fintiv* Factors”) demonstrates that efficiency and integrity of the America Invents Act are best served by denying institution of this Petition, as each factor is either neutral or weighs in favor of denial. Petitioner, however, gives the *Fintiv* analysis short shrift, addressing the six factors cursorily, if at all. Pet., 84-85. And despite acknowledging the earlier ongoing lawsuit against Canadian Solar, *id.*, 79, Petitioner ignores the impact of that proceeding on the *Fintiv* analysis completely. *See id.*, 84-85.⁵ As explained

⁵ Petitioner should not be given the opportunity to submit additional briefing on this issue. Petitioner chose to use its allotted word count to address other issues. *See* Pet., 89 (certifying the Petition “contains 13,975 words”). Given the near lack of discussion regarding *Fintiv* in the Petition, to allow Petitioner additional briefing

herein, evaluating the *Fintiv* factors as a whole, the Board should deny institution.

A. *Fintiv* Factor 1 is neutral: No stay has been requested or granted in the district court proceedings.

Fintiv Factor 1 examines whether the district court in the parallel litigation has granted a stay or if there is evidence suggesting that a stay might be granted if a proceeding is instituted. *Fintiv*, IPR2020-00019, Paper 11 at 6. Neither party in the *Hanwha* proceeding has filed a motion to stay with the district court. EX2022. Similarly, no stay has been requested in the *Canadian Solar* or *REC Solar* proceedings. EX2021; EX2023. And the Board should “decline to infer, based on actions taken in different cases with different facts, how the District Court would rule should a stay be requested by the parties in the parallel case here.” *Fintiv*, IPR2020-00019, Paper 15 at 12 (informative).

Consequently, this factor remains neutral.

B. *Fintiv* Factor 2 favors denial: The ’516 patent will be adjudicated in district court before a final written decision in this IPR.

This factor assesses the proximity of the district court’s trial date to the Board’s projected statutory deadline for a final written decision. *Fintiv*, IPR2020-00019, Paper 11 at 6. The projected statutory deadline for the Board’s final written decision is February 28, 2026.

after the Preliminary Response would reward Petitioner’s gamesmanship.

In the *Hanwha* proceeding, trial is set for May 4, 2026.⁶ EX2022 (*see* Dkt. 33). However, trial in the *Canadian Solar* proceeding is scheduled for January 26, 2026, more than a month prior to the Board’s projected statutory deadline here. EX2021 (*see* Dkt. 33). This trial date is consistent also with the median time to trial in the Eastern District of Texas, which currently is 21.9 months. EX2006, 35. The *Canadian Solar* proceeding was filed on March 25, 2024, thus the scheduled trial date more than twenty-two months from filing. EX2021.

Accordingly, the schedule in the *Canadian Solar* proceeding weighs in favor of denial. *See TCO AS v. NCS Multistage Inc.*, PGR2020-00077, Paper 16 at 11-12 (PTAB Feb. 18, 2021) (determining that a co-pending litigation that will resolve the patentability of the patent at issue weighs in favor of denying institution).

Thus, this factor favors denying institution.

C. *Fintiv* Factor 3 favors denial, or is at least neutral: The parties have and will continue to expend significant effort in the district court litigation.

Factor 3 considers “the amount and type of work already completed in the parallel litigation by the court and the parties at the time of the institution decision.” *Fintiv*, Paper 11 at 9. Here, the Board also looks to the timing of the petition. *Id.*, 11.

⁶ No trial date has been set in the *REC Solar* proceeding.

The *Hanwha* proceeding is in its early stages, but the parties have already been substantially engaged prior to Hanwha's answer/response deadline, as Hanwha sought early dismissal of one of the named defendants, Hanwha Energy Corporation. Substantial negotiations took place on this topic, including at least two meetings between counsel. Hanwha Energy Corporation and Hanwha Solutions Corporation filed Answers and Counterclaims on November 15, 2024. EX2022, 0002 (Dkts. 23, 24). Hanwha also filed a motion to transfer venue that included four declarations from different Hanwha entities and introduced 31 exhibits. *See id.* (Dkt. 25). In response, Maxeon requested and the Court granted expedited limited discovery into the venue related issues raised by Hanwha's motion, including depositions of the four declarants identified in Hanwha's motion and interrogatories. *See id.* (Dkt. 34). Moreover, on November 21, 2024, Maxeon served Infringement Contentions and related disclosures. Maxeon's responses to Hanwha's Counterclaims are due on December 6, 2024.

Further, in the *Canadian Solar* proceeding, the parties have already exchanged infringement and invalidity contentions, served and responded to written discovery requests, and served substantial document productions. And the parties continue to invest time and resources in all three co-pending district court proceedings, as none of the proceedings are stayed.

Thus, this factor weighs in favor of denying institution, or is at least neutral.

TCO, PGR2020-00077, Paper 16 at 11-13 (determining that Patent Owner’s investment in co-pending litigation over the same patent amounts to investment in the parallel proceeding); *Sand Revolution II, LLC v. Continental Intermodal Group — Trucking LLC*, IPR2019-01393, Paper 24 at 10-11 (PTAB June 16, 2020) (informative) (determining *Fintiv* factor 3 “weighs only marginally, if at all, in favor of exercising discretion to deny institution,” where there was some but not substantial investment in the merits of the invalidity positions in the district court proceeding).

D. *Fintiv* Factor 4 favors denial: Hanwha does not provide a stipulation.

“*Fintiv* factor four looks at the overlap between the issues raised in the IPR petition and in the parallel proceeding in order to evaluate ‘concerns of inefficiency and the possibility of conflicting decisions.’” Guidance Memo, 7; *Fintiv*, IPR2020-00019, Paper 11 at 12.

While Hanwha has not yet submitted its invalidity contentions, all but one secondary reference (U.S. Patent Appl. Pub. No. 2013/0240029 to Smith; EX1011) have been identified by Hanwha in its counterclaim for invalidity against the ’315 patent in the district court case. EX2022, 0002 (Dkt. 23); EX2024, 35-37 (Sixth Counterclaim, ¶51). Moreover, there is significant overlap with the asserted grounds here and those presented in the *Canadian Solar* district court proceeding and the co-pending IPR filed by Canadian Solar. *Compare* Pet., 7, with EX2009

(Canadian Solar’s Invalidity Contentions, which include Choi, Cousins, Granek, Marvin, and Istratov), IPR2024-01038, Paper 1 (Pet.) at 5, and IPR2024-01194, Paper 1 (Pet.) at 3-4; *see also Fintiv*, IPR2020-00019, Paper 11 at 12 (overlap of issues favors denial); Guidance Memo, 7 (“If the petition includes the same or substantially the same claims, grounds, arguments, and evidence as presented in the parallel proceeding, this fact has favored denial.”).

Moreover, Hanwha could have, but did not, provide any stipulation here, *Sotera* or otherwise. *See* Guidance Memo, 3, 7-8 (discussing the impact of stipulations on the *Fintiv* analysis).

Thus, factor 4 favors denial.

E. *Fintiv* Factor 5 favors denial: Hanwha and the defendant in the parallel proceeding are the same party.

Hanwha is the defendant in one of the parallel district court actions, which is all that is required to show *Fintiv* factor 5 weighs in favor of denial. *Fintiv*, IPR2020-00019, Paper 11 at 13-14; *Id.*, Paper 15 at 15; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 19 (PTAB Dec. 1, 2020); *Sand Revolution II*, IPR2019-01393, Paper 24 at 12-13.

F. *Fintiv* Factor 6: No other circumstances, including the merits, warrant institution.

Fintiv factor 6 considers any other circumstances that impact the Board’s exercise of discretion, including the merits of the petition. *Fintiv*, IPR2020-00019,

Paper 11 at 14. The Guidance Memo clarifies that with regard to the merits:

Where the information presented at the institution stage is merely sufficient to meet the statutory institution threshold, the PTAB has the authority, where warranted, to exercise discretion to deny institution in view of the other *Fintiv* factors. In contrast, where the PTAB determines that the information presented at the institution stage presents a compelling unpatentability challenge, that determination alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*.

Guidance Memo at 4-5. In *Commscope Techs. LLC v. Dali Wireless, Inc.*, the Director clarified that PTAB panels should “only consider compelling merits if they first determined that *Fintiv* factors 1–5 favored a discretionary denial.”

IPR2022-01242, Paper 23 at 4 (PTAB Feb. 27, 2023) (precedential). As explained above, here *Fintiv* factors 1–5 do favor discretionary denial.

The Director also explained that “*the compelling merits standard is a higher standard* than the standard for institution set by statute” as it requires a showing that “it is *highly* likely that the petitioner would prevail with respect to at least one challenged claim,” rather than being “more likely than not.” *Id.* at 3-4 (citing *Opensky Indus., LLC v. VLSI Tech. LLC*, IPR2021-01064, Paper 102 at 49 (PTAB Oct. 4, 2022) (precedential)). Petitioner includes a bare statement that the “Petition presents compelling merits,” without any attempt at explaining why the asserted grounds meet this higher standard. Pet., 85. And, as explained in detail above,

Hanwha's Petition fails to meet this higher standard. In particular, Hanwha's Petition relies on outdated and incompatible references to support its flawed combinations and fails to articulate why a POSITA would have combined the asserted references. Petitioner's asserted grounds fall well short of meeting the reasonable likelihood standard, let alone the higher compelling merits standard.

For at least these reasons, Hanwha's Petition does not present a compelling unpatentability challenge that would warrant institution despite the other *Fintiv* factors, on balance, weighing in favor of denial. Accordingly, the Board should exercise its discretion to deny institution under § 314(a).

VI. CONCLUSION

For the reasons above, Hanwha fails to show a reasonable likelihood that any of the Challenged Claims is unpatentable as obvious in view of the cited art. Maxeon, therefore, respectfully requests that the Board deny institution.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))

1. This Patent Owner Preliminary Response complies with the type-volume limitation of 14,000 words, comprising 13,041 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

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I certify that the above-captioned **PATENT OWNER'S PRELIMINARY RESPONSE UNDER 37 C.F.R. § 42.107(a)** and associated Exhibits 2001-2006, 2009, 2016-2018, 2021-2024 were served in their entireties on November 29, 2024, upon the following parties via electronic mail:

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