

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANADIAN SOLAR INC.,
Petitioner

v.

MAXEON SOLAR PTE. LTD.,
Patent Owner

Case IPR2024-01194
U.S. Patent No. 11,251,315

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

Mail Stop “PATENT BOARD”
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

TABLE OF CONTENTS

I. INTRODUCTION	1
II. OVERVIEW OF THE '315 PATENT	3
A. The '315 Patent	3
B. The '315 Patent's Novel Solar Cell Fabrication Technique	6
C. The '315 Patent Prosecution History	11
III. PERSON OF ORDINARY SKILL IN THE ART.....	12
IV. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD OF PREVAILING ON ANY CHALLENGED CLAIM.	13
A. All Grounds: CSI fails to show that the prior art discloses “a first emitter region having metal impurities formed over the dielectric region” and “a second emitter region having metal impurities formed over the dielectric region.”	14
1. Grounds 1 and 2: CSI fails to meet the high standard of inherency to show that Li necessarily discloses “a first emitter region having metal impurities” and “a second emitter region having metal impurities.”	15
a. CSI's inherency argument fails because Li does not disclose enough information about its dielectric film to determine whether it will allow for gettering.	17
b. CSI's inherency argument fails because Li and the '315 patent disclose different dopant diffusion processes and heating steps that would affect whether metal impurities are present in the first and second emitter regions.....	25
2. Grounds 3 and 4: CSI fails to show that the combination of Li with Hu and Ramappa teaches “a first emitter region having metal impurities” and “a second emitter region having metal impurities.”	31
a. Hu does not disclose gettering of metal impurities across an oxide layer into a polycrystalline layer.....	32
b. Ramappa does not disclose gettering metal impurities across an oxide layer into a polycrystalline layer.....	34
c. Hu and Ramappa taken together do not teach gettering metal impurities across an oxide layer into a polycrystalline layer....	37

B.	All Grounds: CSI fails to show that it would have been obvious to combine Li with other references to teach the claimed “dopant concentration.”	38
1.	Grounds 1 and 3: A Skilled Artisan would not have been motivated to combine Li with King, Swanson-352, or Marvin.....	39
a.	King, Swanson-352, and Marvin disclose a dopant concentration related to an outdated solar cell structure that would not have been obvious to combine with Li.	40
b.	King, Swanson-352, and Marvin do not disclose an “optimum” dopant concentration.	44
2.	Grounds 2 and 4: A Skilled Artisan would not have been motivated to combine Li with Muller.....	48
V.	THE BOARD SHOULD EXERCISE ITS DISCRETION TO DENY INSTITUTION UNDER § 314(A) and <i>FINTIV</i>	50
A.	<i>Fintiv</i> Factor 1 is neutral: No stay has been requested or granted in the district court proceeding.	51
B.	<i>Fintiv</i> Factor 2 is neutral: Trial is scheduled within two weeks of the PTAB’s final written decision deadline.	54
C.	<i>Fintiv</i> Factor 3 favors denial: The parties have and will continue to expend significant effort in the district court litigation.	56
D.	<i>Fintiv</i> Factor 4 is neutral: The issues raised in the Petition and in the district court overlap completely, and CSI’s stipulation does not prohibit denial.....	57
E.	<i>Fintiv</i> Factor 5 favors denial: CSI and the defendant in the parallel proceeding are the same party.....	60
F.	<i>Fintiv</i> Factor 6: No other circumstances, including the merits, warrant institution.....	61
VI.	CONCLUSION	64

PATENT OWNER'S EXHIBIT LIST

Exhibit No.	Description
2001	Declaration of David Carroll, Ph.D. in Support of Patent Owner Preliminary Response
2002	<i>Intentionally Left Blank</i>
2003	<i>Intentionally Left Blank</i>
2004	Results charted from DocketNavigator.com Document Search, run on October 8, 2024, for Motion to Stay Pending <i>Inter Partes</i> Review Decided by Judge Rodney Gilstrap
2005	Results charted from DocketNavigator.com Document Search, run on October 8, 2024, for Motion to Stay Pending <i>Inter Partes</i> Review Decided by Judge Rodney Gilstrap with “Stipulated/Agreed” Motions Removed
2006	Federal Court Management Statistics (June 30, 2024)
2007	Order Denying Maxeon Partial Motion to Dismiss (Dkt. 26), <i>Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.</i> , Case No. 2:24-cv-00210-JRG (E.D. Tex.), July 3, 2024
2008	Docket Control Order (Dkt. No. 33), <i>Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.</i> , Case No. 2:24-cv-00210-JRG (E.D. Tex.), August 7, 2024
2009	Canadian Solar Inc.’s Invalidity Contentions, <i>Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.</i> , Case No. 2:24-cv-00210-JRG (E.D. Tex.), September 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>

Exhibit No.	Description
2014	<i>Intentionally Left Blank</i>
2015	Granek et al., “Front surface passivation of n-type high-efficiency back junction silicon solar cells using front surface,” <i>Solar Energy Materials and Solar Cells</i> , 91(7) (2007)
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., “Power Games: Project seeks to improve methods of harnessing solar energy,” <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>

I. INTRODUCTION

The Board should deny Petitioner Canadian Solar Inc.’s (“CSI”) Petition for *inter partes* review, which challenges claims 16 and 19 (the “Challenged Claims”) of U.S. Patent No. 11,251,315 (“the ’315 patent”). Claim 16 depends from independent claim 10 and thus incorporates the limitations of claim 10, and claim 19 depends from claim 16 and thus incorporates the limitations of claims 10 and 16. CSI challenges these claims by improperly carving out limitations of claims 10 and 16—one related to dopant concentration and the other to metal impurities—without evaluating how the specification of the ’315 patent explains that these two limitations intertwine and produce unexpected performance improvements in solar cell technology. Yet, even considered separately, CSI’s arguments fail.

First, regarding the metal impurities limitation, CSI relies on a flawed inherency argument, premised on selective and erroneous readings of references, namely Liu-2, Hu, and Ramappa, and is silent when those references (or CSI’s interpretation of them) disagree. CSI further attempts to draw comparisons between the ’315 patent and the primary reference (Li) by glossing over fundamental differences in their fabrication processes—a critical flaw when analyzing art in this field. None of CSI’s arguments, however, show that metal impurities are “necessarily present” in the claimed first emitter region (claim 10) and second emitter region (claim 16), as required for inherency.

CSI then asserts the same Hu and Ramappa references in separate obviousness combinations, but a Skilled Artisan would not have concluded from their teachings that metal impurities would pass through the claimed dielectric region to be present in the claimed first emitter region and second emitter region. Again, CSI relies on selective and erroneous readings of the references and is silent when those references (or CSI's interpretation of them) disagree.

Second, regarding the dopant concentration limitation (claim 10), CSI asserts two challenges, one being based on a decades-old solar cell design that uses a thick oxide passivation layer, which is not present in the primary reference (Li), to provide a dopant concentration in the claimed range. The other challenge asserts a more recent reference, but that reference teaches away from using the dopant concentration in the manner described by Li. To salvage its argument, CSI is forced to change the manufacturing process for Li's solar cell in ways that can only be accounted for by hindsight bias.

Third, the *Fintiv* factors weigh in favor of exercising discretion to deny institution under 35 U.S.C. § 314(a). CSI'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 PTAB deny institution of this IPR and preserve the judicial resources of the PTAB 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, 3:17-21, in tunnel oxide passivated contact (“TOPCon”) solar cell configurations.¹ “Efficiency is an 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.

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 substrate and doped polysilicon regions prior to 2013.

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, ¶41. 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, ¶41. 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. *See* EX1011, 11 (“SunPower is using wafers with lifetimes greater than 1 millisecond.”); EX2001, ¶41. These defects can act as recombination centers where electrons and holes prematurely recombine, reducing the lifetime of charge carriers. EX2001, ¶41. 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, ¶42. This

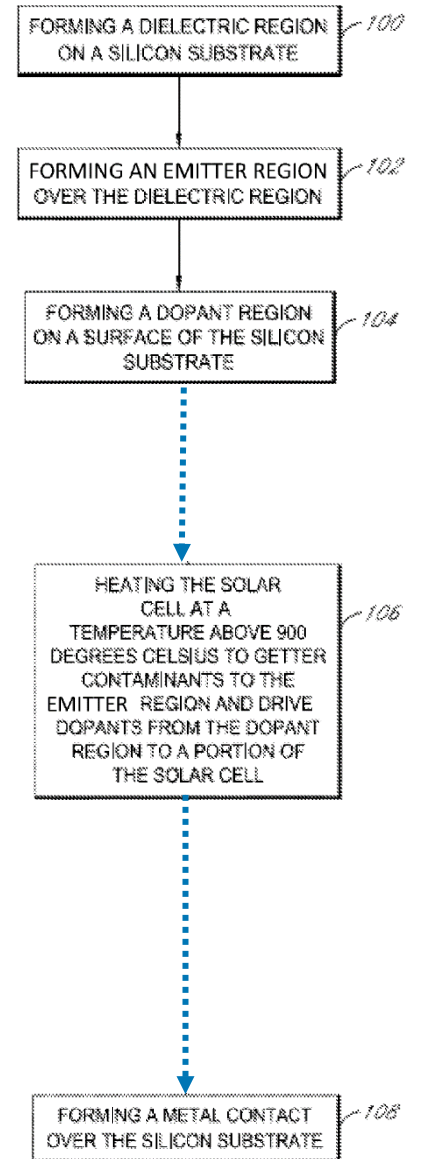
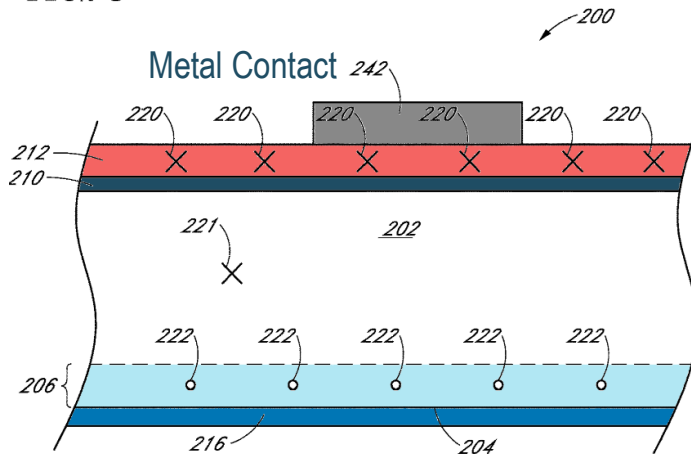
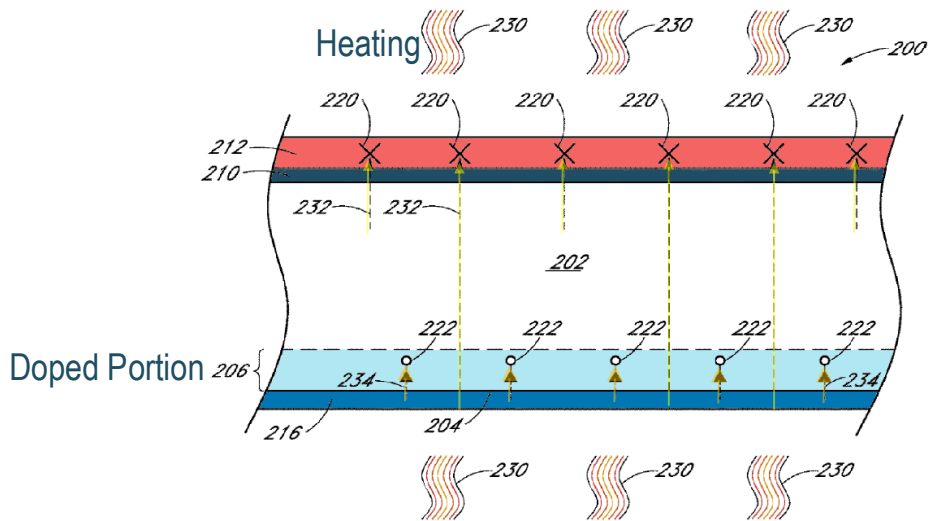
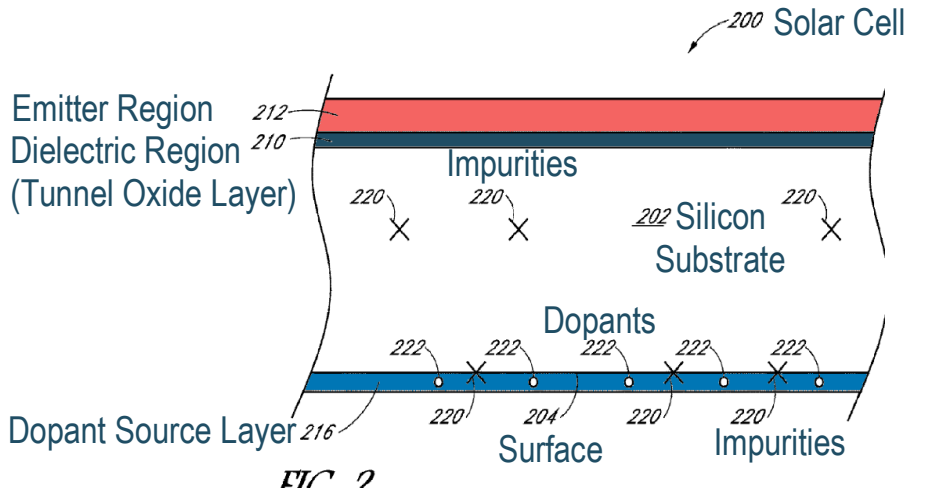
² Additionally, the processes used to improve lifetime, such as thermal treatments, can introduce other challenges, such as increased stress within the solar cell, which can affect its mechanical stability. EX2001, ¶41.

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, ¶42. 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, ¶42. 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.*

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, ¶43. These fabrication steps are illustrated in Figures 1-4 (annotated below).³

³ Throughout its Petition, CSI alleges that the solar cell design disclosed in the '315 patent is a “back-contact solar cell” to draw comparisons with the asserted Li 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, which CSI has not challenged, 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.



EX1001, FIGs. 1-4 (annotated).

The '315 patent explains (and summarizes in Figure 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 *See* EX1001, FIG. 11 (below, color annotations added).

⁴ Maxeon agrees that an inadvertent error was made in Figure 11 that shows all the temperature settings to be less than or equal to 900 degrees Celsius. *See* Pet., 13 n.3. The original application included the same information as Table 1 in the specification, which was later amended to be Figure 11. EX1002, 43. Table 1 in the original application correctly shows that the Example Processes C and D in Figure 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	$2 \times 10^{18} \text{ cm}^{-3}$	non-poly	2 fA/cm^2	$\sim 3 \text{ msec}$	Baseline
B	≤ 900 deg-C	$4 \times 10^{18} \text{ cm}^{-3}$	non-poly	5 fA/cm^2	$\sim 10 \text{ msec}$	Baseline
> 900 deg-C C	≤ 900 deg-C	$2 \times 10^{18} \text{ cm}^{-3}$	poly	2 fA/cm^2	$\sim 10 \text{ msec}$	+0.5 % abs.
> 900 deg-C D	≤ 900 deg-C	$4 \times 10^{18} \text{ cm}^{-3}$	poly	5 fA/cm^2	$\sim 10 \text{ msec}$	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, ¶45.

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, ¶46. 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, ¶47. 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). EX2001, ¶47.

Further, a Skilled Artisan 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.

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.* 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, in which each patent had the same primary examiner.

III. PERSON OF ORDINARY SKILL IN THE ART

CSI's declarant, Dr. Sanjay Banerjee, asserts that the "person of ordinary skill in the art in the 315 Patent's field of solar cell design or manufacture in the December 2014 timeframe ('Skilled Artisan') would have been someone with an advanced degree involving the discipline of electrical engineering, applied physics, chemistry, or materials science, and at least two years of experience designing, developing, or researching in the field." Pet., 11; EX1003, ¶47. Dr. Banerjee also asserts, alternatively, that the Skilled Artisan "would have had a bachelor's degree

in electrical engineering, applied physics, or materials science, and at least three years of experience designing, developing, or researching in the field.” *Id.* For the purposes of this Preliminary Response, Maxeon applies CSI’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). Here, CSI’s Petition asserts four primary grounds of unpatentability (some with multiple alternatives) against the Challenged Claims. Pet., 3-4. As explained below, CSI has not satisfied its burden with respect to *any* of its grounds. So the Board should deny institution.

In particular, none of CSI’s grounds establish that the prior art discloses, teaches, or suggests the claimed “first emitter region having metal impurities formed over the dielectric region” of independent claim 10 (from which claims 16 and 19 depend). Neither do any of CSI’s grounds establish that the prior art discloses, teaches, or suggests the claimed “second emitter region having metal impurities formed over the dielectric region” of dependent claim 16. CSI also fails to show that it would have been obvious to a Skilled Artisan to combine the primary reference (Li) with the secondary references (King, Swanson-352, Marvin,

and Muller) to teach or suggest the claimed “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ ” of independent claim 10.

A. All Grounds: CSI fails to show that the prior art discloses “a first emitter region having metal impurities formed over the dielectric region” and “a second emitter region having metal impurities formed over the dielectric region.”

Li (EX1005) is the only prior-art reference CSI relies on to disclose “a first emitter region having metal impurities” of claim 10 and “a second emitter region having metal impurities” of claim 16. Yet CSI acknowledges that there is nothing about “metal impurities” in the “first emitter region” and the “second emitter region” expressly disclosed in Li. Pet., 47. Instead, CSI resorts to the doctrine of inherency to supply these missing limitations from the prior art. But, as explained below, CSI’s inherency argument fails because “metal impurities” are not “necessarily present” in the “first emitter region” (claim 10) and the “second emitter region” (claim 16). CSI focuses on the similarities between the figures of Li and the ’315 patent⁵—both Maxeon-owned references—to obscure the different

⁵ Li issued as U.S. Patent No. 8,790,957, on July 29, 2014, approximately five months before the parent application to the ’315 patent was filed. Both patents were originally assigned to SunPower Corporation and later assigned to Maxeon Solar Pte. Ltd. after a strategic spin-off of SunPower’s manufacturing and

inventions of each reference and to ignore Maxeon’s explanation of the unexpected results disclosed only in the ’315 patent. But, the limited disclosure about Li’s dielectric film and the differences between the manufacturing processes of Li and the ’315 patent doom CSI’s inherency argument.

As a fallback, CSI asserts two additional references—Hu (EX1017) and Ramappa (EX1025)—neither of which disclose a solar cell (let alone a TOPCon solar cell), and merely repackage CSI’s inherency theory as an obviousness combination. But these additional references do not save CSI’s flawed inherency grounds.

1. Grounds 1 and 2: CSI fails to meet the high standard of inherency to show that Li necessarily discloses “a first emitter region having metal impurities” and “a second emitter region having metal impurities.”

CSI concedes that Li does not include any mention of “emitter regions” that “have metal impurities,” Pet., 47, and relies on inherency to meet this limitation. But CSI fails to meet the high standard for inherency to show that “metal impurities” are necessarily present in Li’s polysilicon doped regions of material

international operations. Li and the ’315 patent name David Smith as a common inventor.

layer 506 (e.g., the “first emitter region” and the “second emitter region”).⁶

EX2001, ¶¶53-73.

“‘[T]o rely on inherency to establish the existence of a claim limitation in the prior art in an obviousness analysis,’ [a petitioner] must show the . . . limitation is ‘necessarily present’ or ‘the natural result of the combination of elements explicitly disclosed by the prior art.’” *LBT IP I LLC v. Apple Inc.*, No. 2022-1613, 2023 WL 3914920, at *3 (Fed. Cir. June 9, 2023) (quoting *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1195–96 (Fed. Cir. 2014)); *see also Ultratec, Inc. v. Sorenson Commc’ns, Inc.*, No. 14-cv-66-JDP, 2015 WL 5330284, at *13 (W.D. Wis. Sept. 11, 2015) (explaining that an “inherent disclosure is not established by showing that a claim element would be a ‘logical’ choice” and “[i]nherency requires necessity”). Moreover, inherency “may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *PAR*, 773 F.3d at 1195 (quoting *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)). As discussed below, CSI’s own cited

⁶ CSI identifies the “polysilicon doped regions of the material layer 506” in Li as corresponding to the claimed “first and second emitter regions” of claims 10 and 16. Pet., 43-44, 47.

references used for its inherency theory create contradictions, which CSI makes no attempt to reconcile, leaving more questions than answers in its grounds.

a. CSI's inherency argument fails because Li does not disclose enough information about its dielectric film to determine whether it will allow for gettering.

CSI not only assumes that Li's dielectric film allows diffusion of metal impurities during a gettering process, but also misinterprets the teachings of the cited references to wrongly conclude that "the art amply demonstrates that Li's heating and diffusing of the dopants into the polysilicon layer at 950°C . . . would necessarily have resulted in impurities being gettered and present in both of Li's doped polysilicon emitter regions, even despite an intervening thin 1-2 nm interfacial silicon oxide layer." Pet., 53 (emphasis omitted).

To support its inherency argument, CSI argues that "publications before and after December 2014 show that metallic impurities are transferred from silicon substrates into polysilicon layers, including through thin silicon oxide layers . . . by gettering." Pet., 48. But that is not what the references that CSI cites teach. To the contrary, Liu-2 (EX1029) states that there are large "[d]iscrepancies in the reported iron solubility in SiO₂" and "the results are contradictory," which "make[s] it difficult to assess and quantify the blocking mechanisms of the oxide interlayer" between a substrate and a polysilicon film. EX1029, 140. Liu-2 found that "optimum polysilicon fabrication conditions" must be implemented for the

blocking effect of an oxide interlayer to be small. *Id.*, 141. As explained below, Liu-2 (1) discloses configurations where gettering into polysilicon layers will not occur, and (2) contradicts CSI's claims related to the teachings of Hu and Ramappa.

First, Liu-2 compared the gettering effectiveness of polysilicon layers by “varying the interlayer oxide properties (chemical oxide, thermal oxide of different thicknesses, and no oxide), and replacing the dopant diffusions with nitrogen anneals.” *Id.*, 137. Figure 3 of Liu-2 shows the results of this comparison, where effective gettering is indicated by a low bar (or no bar) on the chart. *Id.*, 139 (shown below); EX2001, ¶56.

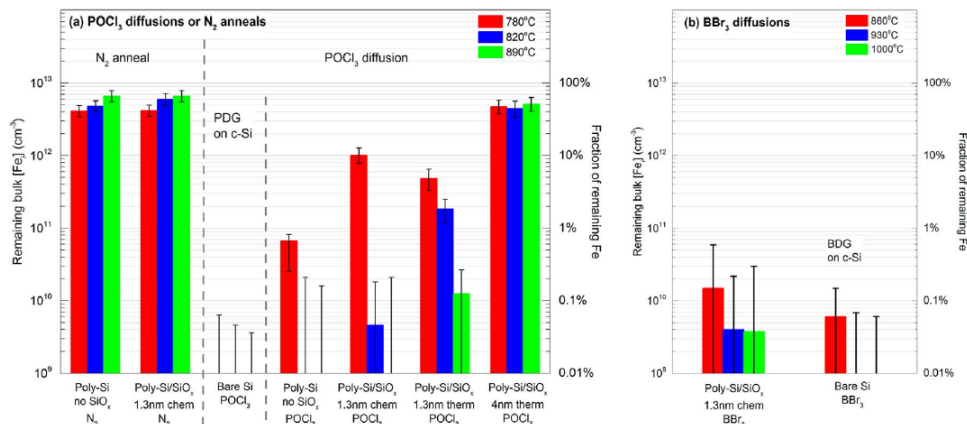
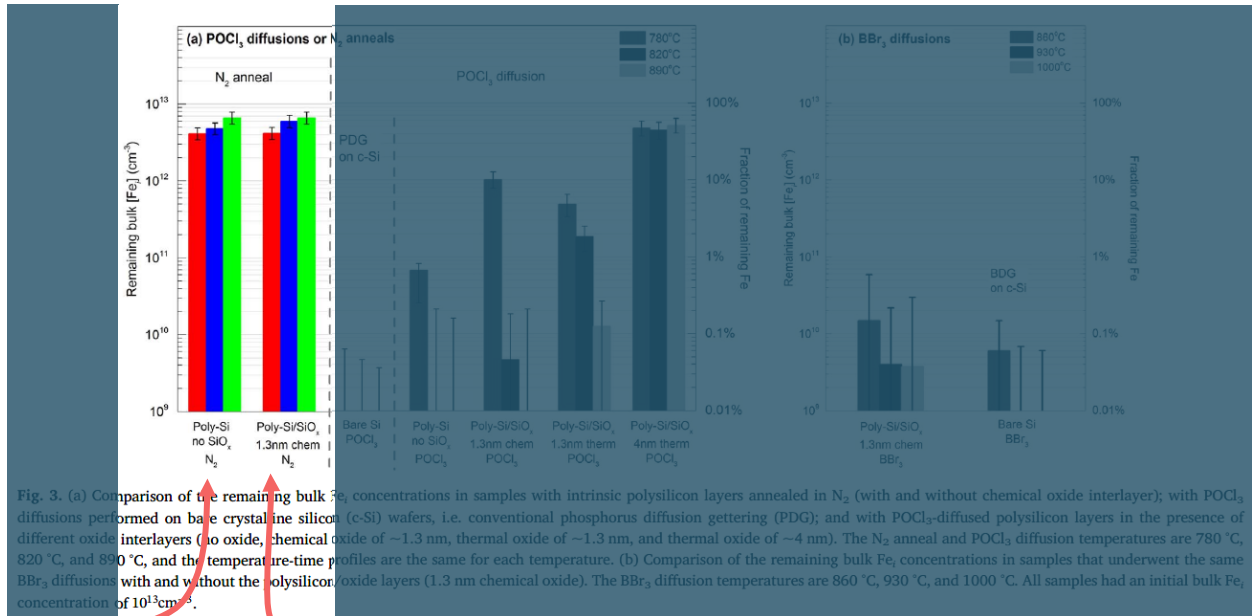


Fig. 3. (a) Comparison of the remaining bulk Fe_i concentrations in samples with intrinsic polysilicon layers annealed in N₂ (with and without chemical oxide interlayer); with POCl₃ diffusions performed on bare crystalline silicon (c-Si) wafers, i.e. conventional phosphorus diffusion gettering (PDG); and with POCl₃-diffused polysilicon layers in the presence of different oxide interlayers (no oxide, chemical oxide of ~1.3 nm, thermal oxide of ~1.3 nm, and thermal oxide of ~4 nm). The N₂ anneal and POCl₃ diffusion temperatures were 780 °C, 820 °C, and 890 °C, and the temperature-time profiles are the same for each temperature. (b) Comparison of the remaining bulk Fe_i concentrations in samples that underwent the same BBr₃ diffusions with and without the polysilicon/oxide layers (1.3 nm chemical oxide). The BBr₃ diffusion temperatures are 860 °C, 930 °C, and 1000 °C. All samples had an initial bulk Fe_i concentration of 10¹³cm⁻³.

EX1029, FIG. 3.

Starting from the left, Figure 3 shows that “intrinsic [(i.e., undoped)] polysilicon films . . . do not have a significant gettering action . . . with [or] without the oxide

interlayer.” EX1029, 139, FIG. 3 (annotated below). Similarly, Li discloses doped polysilicon regions in material layer 506, but lacks any discussion about to what extent the layer is doped and CSI offers no analysis on this point. EX2001, ¶57.

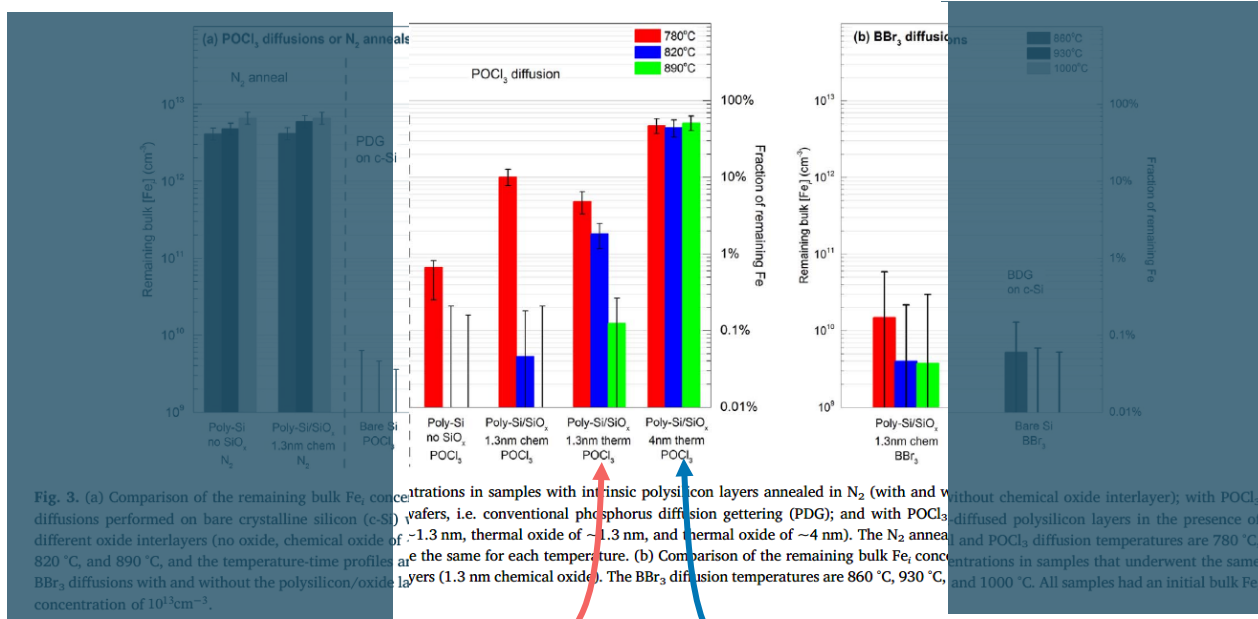


Poly-Si/SiO_x 1.3nm chem, N₂ = Polysilicon layer with interfacial oxide of 1.3 nm thickness, formed by chemical oxide, no doping
Poly-Si no-SiO_x N₂ = Polysilicon Emitter with no interfacial oxide, no doping

EX1029, FIG. 3 (annotated).

Figure 3 of Liu-2 also shows that “[t]he gettering effectiveness of both polysilicon contacts and diffused c-Si wafers . . . increase[s] with increasing diffusion temperature[s], for both POCl₃ and BBr₃ diffusions,” but “[f]or samples with a 4-nm thick thermal oxide interlayer, ineffective gettering is observed for all diffusion temperatures.” EX1029, 139-40, FIG. 3 (annotated below). This finding of Liu-2 directly contradicts CSI’s argument that “iron diffuses readily across

silicon dioxide layers even much thicker (50-100nm).” *See* Pet., 49 (discussing Ramappa); EX2001, ¶58. CSI provides no explanation for this contradiction.

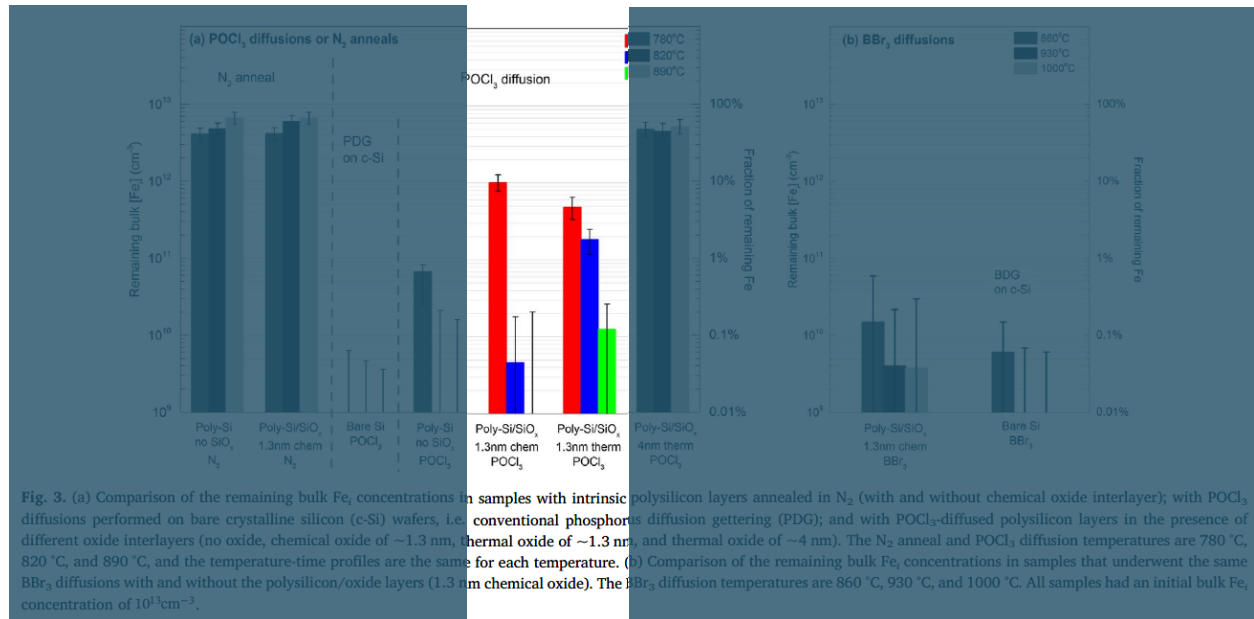


Gettering effectiveness for n-type (POCl₃) doped Polysilicon with 1.3 nm thermal oxide improves temperature increases.

Ineffective gettering for n-type (POCl₃) doped Polysilicon with 4 nm thermal oxide regardless of temperature increase.

EX1029, FIG. 3 (annotated).

Figure 3 of Liu-2 further shows that gettering effectiveness is related to how the oxide layer is grown. EX1029, FIG. 3 (annotated below). Liu-2 states that “[t]he different gettering effectiveness of the chemical and thermal oxides of the same thickness likely relate to the different oxide density achieved by the two growth methods.” *Id.*, 140. In contrast, the primary reference Li is silent on how its dielectric film is formed, and CSI offers no argument on this point either. EX2001, ¶59.



Gettering for n-type (POCl₃) doped Polysilicon with 1.3 nm oxide is more effective for chemically grown oxide versus thermally grown oxide

EX1029, FIG. 3 (annotated).

Thus, Liu-2 teaches that a variety of structural and process dependent variables influence whether an oxide layer will allow effective gettering. And CSI has not demonstrated that all of these variables are disclosed by Li such that gettering of metal impurities through Li's dielectric film is inevitable. EX2001, ¶60. CSI simply leaves these loose ends unaddressed.

Second, Liu-2's teachings about gettering contradict CSI's claims related to Hu and Ramappa. EX2001, ¶61. Hu discloses "[a]n integrated circuit structure [(i.e., not a solar cell)] . . . which provides for gettering with a backside layer of polycrystalline silicon" that is "either undoped or suitably doped with oxygen." EX1017, Abstract, 3:24-27. CSI claims that Hu teaches "metal impurities in the

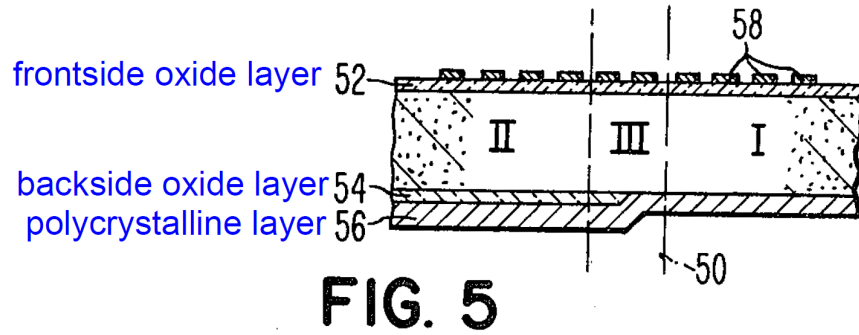
silicon substrate would have naturally and inevitably gettered to the backside polysilicon ‘material layer’ of Li.” Pet., 49. But according to Liu-2, undoped (or intrinsic) polysilicon films have an “inability . . . to getter bulk impurities.” EX1029, 139. CSI makes no attempt to reconcile the teaching of Liu-2 with Hu regarding the gettering effectiveness of polysilicon layers. Fortunately, Liu-2 explains that in its solar cell, the polysilicon film was

deposited by PECVD at a low temperature at ~250°C, while those used in microelectronics for backside gettering purposes consist of polysilicon deposited by CVD at much higher temperatures of 600-800°C. In addition, the recommended film thickness for backside polysilicon gettering is 500 nm to 3 µm, which is much thicker than our 30–40 nm deposited a-Si films, offering more grain boundary area for impurity segregation and relaxation. . . . [T]he provision of a sufficient amount of grain boundaries is important for the gettering action of intrinsic polysilicon layers, that is, the thickness ratio of the polysilicon film to the bulk crystalline silicon substrate, where impurities are gettered from, should be considered.

Id., 139. Indeed, Hu is a microelectronics patent and discloses polycrystalline silicon films formed within those ranges of temperatures and thicknesses. *See* EX1017, 14:58-15:10 (claiming a layer of polysilicon, “wherein the temperature for depositing said layer is between about 680°C and 800°C and the thickness of said layer being between about 5000 Å and 50000 Å” (i.e., 500 nm to 5 µm)). Li is silent about the thickness of its backside polysilicon material layer 506, the

temperature at which it is formed, and the thickness ratio between the backside polysilicon material layer 506 and the substrate 508, which all impact whether gettering would occur. EX2001, ¶62. CSI is also silent regarding the same and fails to show that metal impurities would be inherently getterred to the backside polysilicon material layer 506 through dielectric film 510 in Li. *Id.*

Regarding Ramappa, which discloses a “quantitative analysis of diffusion of iron in silicon dioxide,” CSI claims that “iron diffuses readily across silicon dioxide layers even much thicker (50-100nm) than the 1-2 nm layer used by Li.” EX1025, 3773; Pet., 49. Liu-2, however, teaches that “[f]or samples with a 4-nm thick thermal oxide interlayer, ineffective gettering is observed for all diffusion temperatures.” EX1029, 140; *see also* EX1026, ¶¶47, 54 (teaching that “the group of impurity metals [can] hardly pass through the SiO₂ film” that was 50 nm thick). Moreover, Hu discloses “an oxide layer on frontside 52 and backside 54” that extends across region I, but not region II, of the structure, and “it was expected that gettering would take place in region I, but not in region II because of the presence of an intermediary oxide barrier.” EX1017, 8:29-44, FIG. 5 (annotated below).



EX1017, FIG. 5 (annotated).

In view of Liu-2, Yoshimura, and Hu—which all disclose oxide layers that prevent gettering—CSI fails to reconcile how it can assert that Ramappa’s 100 nm oxide layer could allow for gettering. EX2001, ¶¶55-64. CSI is inexplicably silent on this critical difference in the references relied on for its inherency arguments.

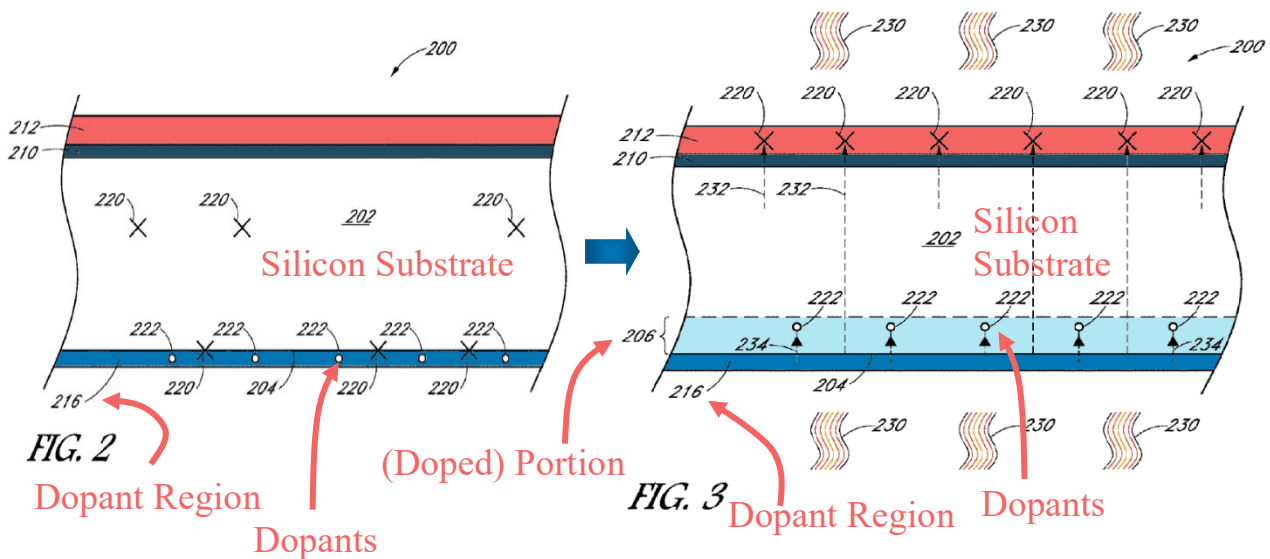
Thus, the art demonstrates that “it [is] difficult to assess and quantify the blocking mechanisms of the oxide interlayer” without at least the information about its numerous variables, such as formation processes, temperatures, densities, dopants, thickness, etc. EX1029, 140; EX2001, ¶65. As Li is silent about this information regarding its dielectric film 510, CSI’s claim that “metal impurities in the silicon substrate would have naturally and inevitably getterred to the backside polysilicon ‘material layer’ of Li,” Pet., 49, through the dielectric film is mere speculation, far from meeting its high standard to prove inherency.

- b. CSI's inherency argument fails because Li and the '315 patent disclose different dopant diffusion processes and heating steps that would affect whether metal impurities are present in the first and second emitter regions.**

Li and the '315 patent use different doping processes and high-temperature heating steps at different stages of their fabrication processes, and CSI has not shown that, despite these differences, "metal impurities" will necessarily be gettered into the "material layer" of Li. *See LBT IP*, No. 2022-1613, 2023 WL 3914920, at *3 (explaining that inherency requires showing the claim limitation is necessarily present in the prior-art combination). Initially, CSI asserts that Li and the '315 patent are the same regarding their (1) doping processes and (2) heating steps. Pet., 23, 47. Later, CSI concedes that Li discloses a different heating approach, but claims that it would have been obvious to a Skilled Artisan to make Li like the '315 patent. *Id.*, 53 n.9. CSI's blending of inherency and obviousness arguments is improper. *Vivint, Inc. v. Alarm.com Inc.*, 741 F. App'x 786, 792 (Fed. Cir. 2018) ("[W]hat would have been obvious to a skilled artisan is not a valid consideration in an inherency analysis.").

Different Doping Processes. CSI incorrectly states that "*like the 315 Patent*, Li describes diffusing dopants at the front surface to form the front portion

520 (shown in red above) with a ‘gaseous N-type dopant source.’”⁷ Pet., 23. But the ’315 patent does not dope the front surface with a “gaseous N-type dopant source;” rather it discloses that “a dopant region 216 can be formed on a surface 204 of silicon substrate 202,” and a high-temperature heating step drives “the dopants 222 from the dopant region 216 to a portion 206 of the silicon substrate 202.” EX1001, 4:55-56, 5:64-67, FIGs. 2, 3 (annotated below).



EX1001, FIGs. 2, 3 (annotated).

Figure 3 shows the portion 206 that is doped by driving dopants 222 from the dopant region 216 in the silicon substrate 202. Accordingly, the ’315 patent is not “just like” Li because it does not disclose a “gaseous” drive-in method. EX2001, ¶¶67-68.

⁷ Emphasis added unless otherwise noted.

Different Heating Steps. CSI also alleges that the '315 patent discloses that “heating the solar cell above 900°C can getter metal impurities into the emitter region and at the same time *perform dopant diffusion*,” and that “[i]n Li, dopant diffusion is conducted above 900°C, *just like in the 315 Patent*.” Pet., 46-47. CSI improperly conflates the high-temperature heating step that diffuses dopants into the front surface of the substrate in the '315 patent (discussed above) with Li's diffusing of dopants into the emitter regions on the back of the substrate 508. EX2001, ¶69. Li discloses that the high-temperature (950°C) dopant diffusion step occurs when portions 512 and 514 of Li's material layer 506 (e.g., the “first emitter region” and the “second emitter region”) are doped. *See* EX1005, ¶¶44-45 (explaining that dopant source layers 502, 504 are heated to transfer dopants into portions 512, 514), FIGs. 4 (operation 404 of flowchart 400), 5A, 5B (annotated below).

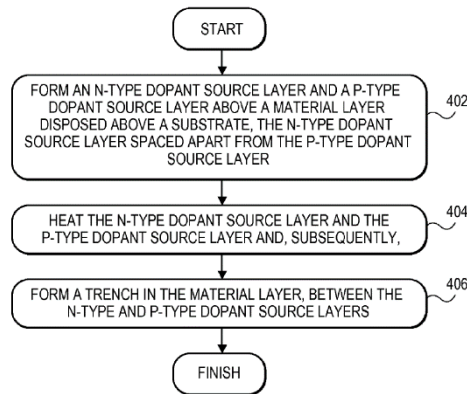
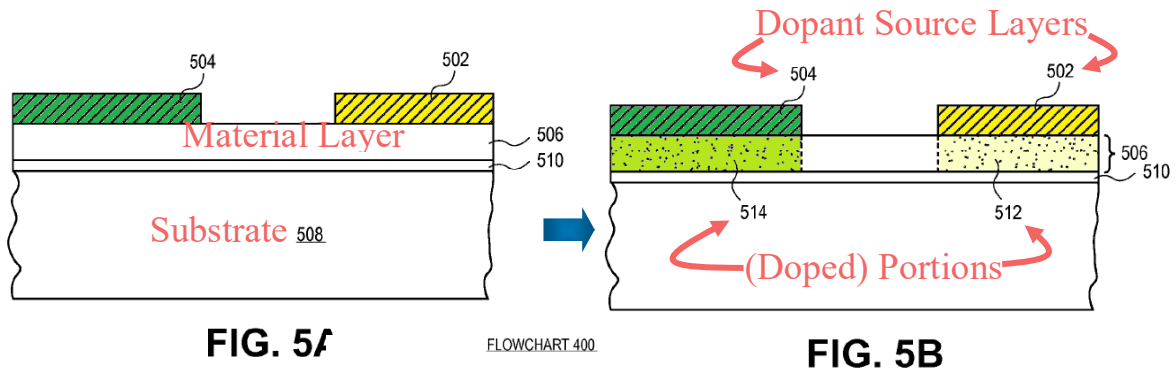


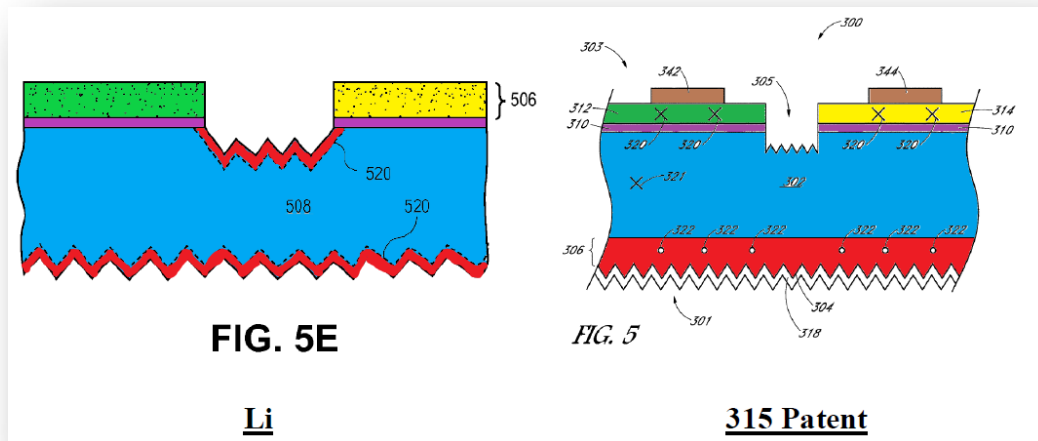
FIG. 4

EX1005, FIGs. 4, 5A, 5B (annotated).

To be clear, the high-temperature heating step in Li dopes the emitter regions, whereas the high-temperature heating step in the '315 patent dopes the silicon substrate. EX2001, ¶70. The “dopant regions 520” in Li, which CSI identifies as the doped portion of the silicon substrate 508, are not formed until several steps later by “heating substrate 508 . . . in the presence of a gaseous N-type dopant source.” EX1005, ¶49. Thus, Li does not disclose “perform[ing] dopant diffusion . . . just like in the 315 Patent” because the high-temperature heating step is performed at different times and to drive dopants in different

regions. Pet., 46-47; *see* EX2001, ¶70. These timing differences are not insignificant—a Skilled Artisan would have understood the need to account for the thermal history of the substrate when implementing additional heating steps. *See* EX2001, ¶70.

A comparison of Figure 5E in Li with Figure 5 of the '315 patent (annotated by CSI) confirms these differences between the dopant processes and heating steps of the '315 patent and Li. *See* Pet., 22 (reproduced below).



Pet., 22 (comparing EX1005, FIG. 5E (left) to EX1001, FIG. 5 (right)). As shown, unlike the doped portion 306 of the '315 patent, dopant regions 520 in Li are on the front surface of the substrate 508 *and in the trench*, indicating that substrate doping occurred after the trench was formed, whereas the '315 patent has no doping in the trench, indicating that doping occurred before the trench was formed. *See* Pet., 22 (figure comparison); EX2001, ¶72. Moreover, the profile of the dopant regions 520 in Li follows the textured surface profile indicating that

doping was performed after texturing, unlike the '315 patent. *See* Pet., 22 (figure comparison); EX2001, ¶72. The doped portion 306 of the '315 patent also extends further into the silicon substrate 302 than the dopant regions 520 in Li, which is consistent with the high-temperature heating step for driving dopants into the silicon substrate disclosed by the '315 patent, and not the “gaseous” drive-in method disclosed by Li. *See* Pet., 22 (figure comparison); EX2001, ¶72.

CSI concedes that Li uses a “two-step heating approach for the back and front of the solar cell.” Pet., 53 n.9. But rather than admit that Li does not disclose a high-temperature heating step for doping the front side of the substrate 508, CSI incorrectly contends that “it would also have been obvious to the Skilled Artisan to combine the two heating steps of Li into a single heating step for the doping of the front and back sides of the solar cell.” *Id.* CSI’s contention here is improper as a matter of law: “[W]hat would have been obvious to a skilled artisan is not a valid consideration in an inherency analysis.” *Vivint, Inc.*, 741 F. App’x at 792.⁸

⁸ CSI’s proposed obviousness combination is also wrong technically. CSI’s declarant, Dr. Banerjee, proposes “using a single loading of the solar cell into a single heating furnace after the deposition of the back side dopant sources onto the polysilicon layer and include the gaseous dopant for diffusion into the front portion.” EX1003, ¶171. That is, Dr. Banerjee proposes introducing a gaseous

Accordingly, CSI's inherency argument based on Li in view of the '315 patent fails. In addition, the same shortcomings in CSI's inherency arguments for other references intended to cure the omissions in Li (discussed *infra*) apply equally here.

2. Grounds 3 and 4: CSI fails to show that the combination of Li with Hu and Ramappa teaches “a first emitter region having metal impurities” and “a second emitter region having metal impurities.”

CSI contends that Li in view of Hu and Ramappa teaches claim 10's “first emitter region having metal impurities” and claim 16's “second emitter region having metal impurities.” Pet., 70-74. But CSI fails to show the “first emitter region having metal impurities” when “formed over the dielectric region,” as required by claim 10. EX1001, 10:59-60. Also, CSI fails to show the “second

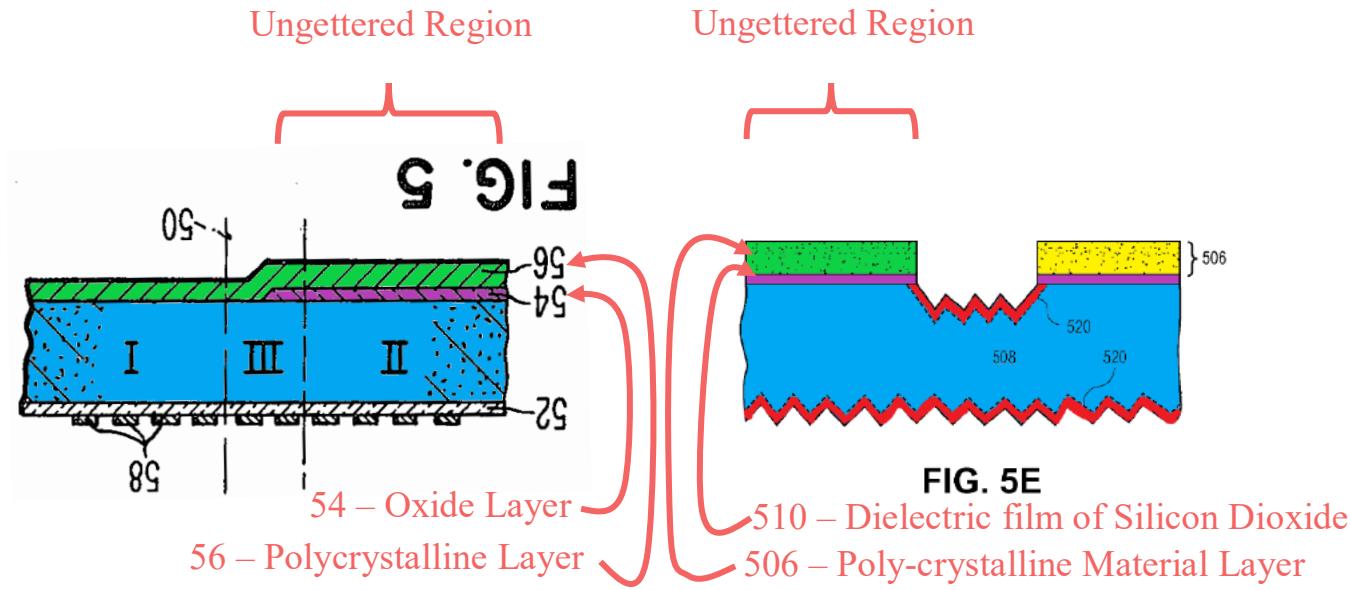
dopant at the emitter doping stage shown in Figure 5B of Li. Dr. Banerjee recognizes the problem that a gaseous phosphorus (i.e., n-type) dopant will cross-dope the p-type polysilicon region, so he further proposes depositing “a diffusion mask” on the backside of the substrate. EX1003, ¶171. But the purpose of Li's invention is to avoid the “ledge” feature, “which may undesirably result from partial mask 210 lift-off 218 and/or undercut 220 of mask 206 during the etch process,” so re-introducing a mask over the same problematic region would not have been obvious. EX1005, ¶31; EX2001, ¶73.

emitter region having metal impurities” when “formed over the dielectric region,” as required by claim 16. EX1001, 11:6-7. The specification of the ’315 patent discloses that “heating at temperatures above 900 degrees Celsius can include gettering metal impurities 220 through the dielectric region 210, e.g., tunnel oxide, to into [sic] the emitter region 212, e.g., polysilicon regions.” *Id.*, 5:21-25. A Skilled Artisan would not have combined the teachings of Hu and Ramappa with Li because, as explained below, these references do not teach “metal impurities” in the “emitter regions” formed over the “dielectric region” of Li. EX2001, ¶¶74-84.

a. Hu does not disclose gettering of metal impurities across an oxide layer into a polycrystalline layer.

CSI argues that Hu teaches the “gettering of metal impurities from a silicon ‘semiconductor body’ into a ‘polycrystalline layer’ on the backside of the silicon at temperatures of 1000°C or less.” Pet., 71. But CSI fails to address Hu’s explicit disclosure of a region where the polycrystalline layer is separated from the silicon by an oxide layer and gettering does not occur. EX1017, 8:39-44.

Figure 5 of Hu illustrates “region I,” which has a polycrystalline layer 56 deposited on the backside of the silicon wafer 50, and “region II,” which has a backside oxide layer 54 formed between the silicon wafer 50 and the polycrystalline layer 56. EX1017, FIG. 5 (annotated, below left). Similarly, Li discloses dielectric film 510 in between the poly-crystalline material layer 506 and substrate 508. EX1005, FIG. 5E (annotated by CSI, below right).



EX1017, FIG. 5 (annotated).

EX1005, FIG. 5E (annotated).

Hu explains that “it was expected that gettering would take place in region I, but not in region II because of the presence of an intermediary oxide barrier.” EX1017, 8:39-44. Table I of Hu confirms that Region II between the backside oxide layer 54 and the semiconductor body 50 is “ungettered.” EX1017, 9:47-54 (Table I annotated below).

TABLE I			
Column	Region	Mean Generation Current Nano Amp/cm ²	Remarks
1-4	II	108	ungettered transition region region gettered
5-6	III	3.4	
7-10	I	1.7	

EX1017, Table I (annotated).

Accordingly, Hu does not disclose—rather, it teaches away from—gettering impurities into the polycrystalline layer formed over the oxide layer. EX2001, ¶¶75-78.

b. Ramappa does not disclose gettering metal impurities across an oxide layer into a polycrystalline layer.

Ramappa's teachings directly contradict CSI's claim that "[b]ased on Ramappa, it would be apparent to the Skilled Artisan that iron would readily diffuse across Li's 1-2 nm silicon dioxide layer into both doped polysilicon emitter regions of Li." Pet., 73-74. Ramappa does not contemplate gettering or the diffusion of metal impurities from a silicon oxide layer into a polysilicon layer. *See generally* EX1025; EX2001, ¶79. Rather, as shown in Figure 1, Ramappa analyzes iron traveling from the SiO₂ layer into the silicon bulk, not out of the silicon bulk. *Compare* EX1025, FIG. 1, *with* EX1005, FIG. 5E (annotated, below right); EX2001, ¶79. Applying this teaching to Li, as CSI proposes, a Skilled Artisan would have understood that the diffusion of metal impurities in Li's structure would be away from the poly-crystalline material layer 506. *See* EX2001, ¶79.

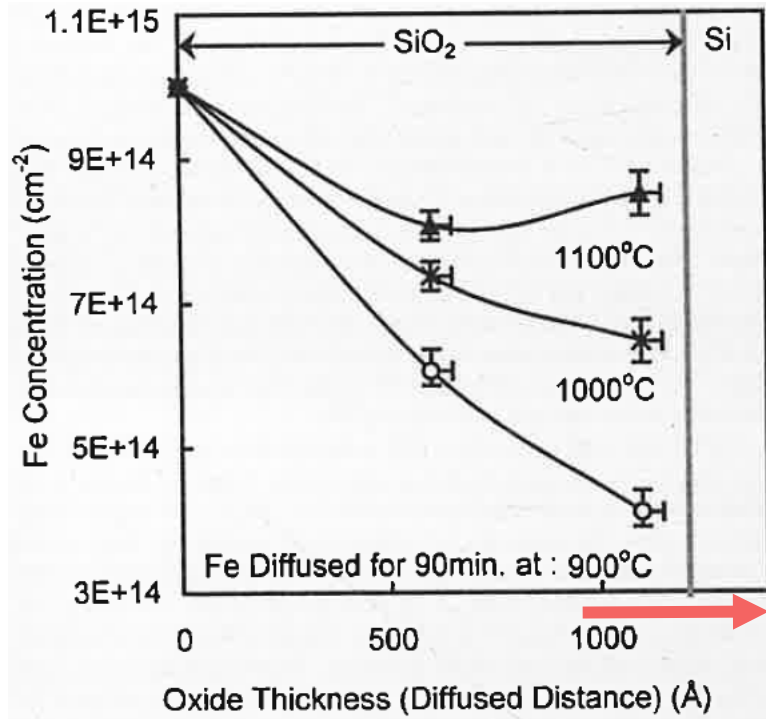


Figure 1. Iron concentration profile in SiO_2 following in-diffusion at temperatures of 900, 1000, and 1100°C for 90 min. Iron concentrations were measured by TXRF.

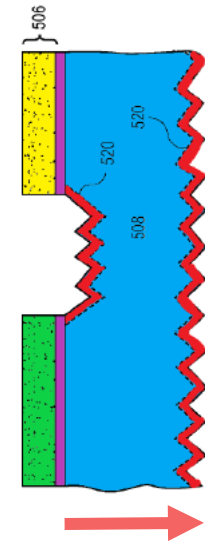


FIG. 5E

EX1025, FIG. 1 (annotated, left); EX1005, FIG. 5E (annotated, right).

There is also no teaching in Ramappa about a silicon oxide layer acting as a tunnel oxide barrier layer between a substrate and a polysilicon material layer.

EX2001, ¶80. The context and direction of diffusion studied in Ramappa are opposite from what is required for gettering metal impurities from Li's substrate 508 to the poly-crystalline material layer 506. *Id.* The findings in Ramappa actually suggest that the silicon oxide layer would act as a barrier, preventing such diffusion and thereby impeding any gettering process through this layer:

[I]t is observed that in agreement with previous published literature iron has a strong tendency to preferentially segregate to the SiO_2 side

of the SiO_2 -Si interface. This strong segregation tendency seemingly *impedes the diffusion of iron from SiO_2 into the silicon bulk*. In the process the segregation could lead to supersaturation of iron impurity and eventually precipitation which in turn could prove detrimental to the gate oxide integrity.

EX1025, 3776. That is, Ramappa discloses that silicon dioxide acts as an impurity sink and does not readily allow iron to pass from the silicon dioxide layer to the silicon bulk—as illustrated in Figure 5 (below).

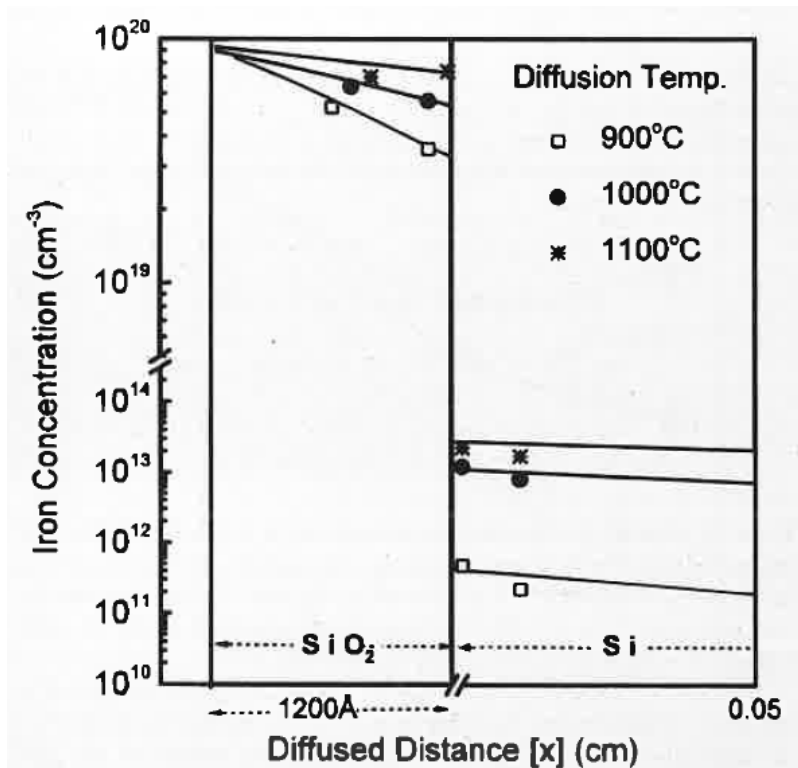


Figure 5. Iron impurity diffusion profile in SiO_2 and Si at temperatures of 900, 1000, and 1100°C. The solid lines represent the concentration profile as predicted by the two-boundary diffusion model. Iron concentrations in SiO_2 was measured by TXRF and in the Si bulk by DLTS and SPV.

EX1025, FIG. 5.

Id.; EX2001, ¶81. Figure 5 shows a starting iron concentration of 10^{20} cm^{-3} that drops to under 10^{12} cm^{-3} (8 orders of magnitude) when entering the silicon bulk at 900 degrees Celsius. Thus, a Skilled Artisan reading Ramappa would have concluded that the silicon dioxide layer 510 of Li would act as an impurity sink to metal impurities, instead of allowing metal impurities to be gettered into the polycrystalline material layer 506. EX2001, ¶82.

c. Hu and Ramappa taken together do not teach gettering metal impurities across an oxide layer into a polycrystalline layer.

Based on the teachings of Hu and Ramappa, a Skilled Artisan would not have found the presence of metal impurities in Li's polysilicon material layer 506 to be obvious. From the combination of Hu's structure and Ramappa's disclosure that "iron has a strong tendency to preferentially segregate to the SiO_2 side of the SiO_2 -Si interface . . . [, which] impedes the diffusion of iron from SiO_2 into the silicon bulk," EX1025, 3776, a Skilled Artisan would have concluded that Region II in Hu is ungettered because of the oxide layer between the silicon and polysilicon layers. EX2001, ¶83. Thus, applying Hu's and Ramappa's teachings to Li's structure, a Skilled Artisan would have concluded that no metal impurities are gettered into Li's polysilicon material layer 506 due to the presence of Li's silicon dioxide film 510 between its substrate 508 and polysilicon material layer 506. *Id.*

Moreover, CSI makes no mention of the oxide layer in Hu nor provides an explanation for Ramappa's express teaching that "[t]he SiO₂-Si interface is known to act as a sink for impurities." EX1025, 3775. CSI bears the burden of proving obviousness and must "articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness." *In re Magnum*, 829 F.3d at 1380. CSI fails to carry that burden here and does not show that the prior art renders obvious "a first emitter region having metal impurities" (claim 10) and "a second emitter region having metal impurities" (claim 16).

B. All Grounds: CSI fails to show that it would have been obvious to combine Li with other references to teach the claimed "dopant concentration."

Independent claim 10, from which claims 16 and 19 depend from, recites "the silicon substrate has a dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$." Conceding that Li does not disclose this limitation of the Challenged Claims, CSI improperly relies on selected secondary references to fill Li's gaps. Pet., 39-41, 68-69.

For Grounds 1 and 3, CSI relies on three references—King (EX1006), Swanson-352 (EX1015), and Marvin (EX1035)—disclosing outdated and incompatible solar cell configurations that a Skilled Artisan would not have considered when determining a suitable dopant concentration for the portion of the silicon substrate at the front side of the solar cell in Li. CSI also ignores the

teachings of more recent references, such as Granek (EX2015), that show using higher dopant concentrations on the front surface of substrates to eliminate the need for a thick oxide passivation layer, as in the solar cell configurations of King, Swanson-352, and Marvin.

For Grounds 2 and 4, based on the combination of Li and Muller (EX1008), CSI proposes a new solar cell configuration that would not have been obvious absent CSI's hindsight based on the '315 patent. Indeed, the proposed solar cell would only have been achieved through hindsight, as CSI proposes significant modifications to Li's solar cell—adding ion-implanting steps, changing dopant polarities, adding new passivation layers, reversing fabrication order, and adding masking techniques—contradicting Li's goal of reducing the number of process operations. Essentially, CSI's modifications completely overhaul Li, highlighting CSI's hindsight.

Therefore, CSI fails to carry its burden to show that the Challenged Claims would have been obvious.

1. Grounds 1 and 3: A Skilled Artisan would not have been motivated to combine Li with King, Swanson-352, or Marvin.

CSI's obviousness argument is contradicted by the prior art itself, which discloses different and conflicting dopant concentrations depending on various design parameters, such as the radiation environment, the thickness of the silicon

oxide passivation layer, and the shape of the dopant profile. EX2001, ¶¶95-99. CSI also ignores the teachings of more recent references, such as Granek, that show higher dopant concentrations were used and preferred for back-contact solar cells with thin silicon oxide passivation layers. EX2001, ¶¶88-94. Therefore, CSI fails to establish a prima facie case of obviousness based on its selective and erroneous reading of the prior art.

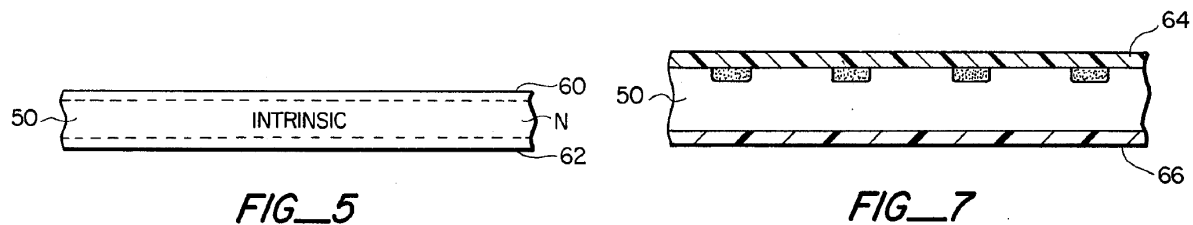
- a. **King, Swanson-352, and Marvin disclose a dopant concentration related to an outdated solar cell structure that would not have been obvious to combine with Li.**

In its proposed combinations with Li, CSI provides no explanation of why a Skilled Artisan would have found it obvious to look to the different solar cell configurations of King, Swanson-352, and Marvin for determining dopant concentrations in the front sides of solar cells. These solar cell structures are incompatible with Li. EX2001, ¶88.

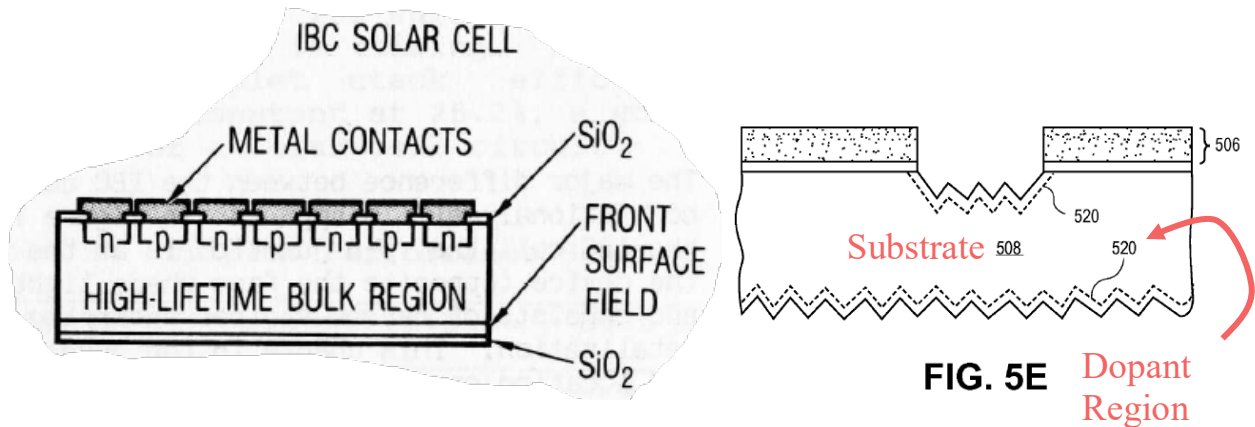
The disclosures in King, Swanson-352, and Marvin hearken back to an era when Interdigitated Back Contact (IBC) cells included thick silicon oxide passivation layers formed over both sides of the silicon substrate. *See* EX1006, 366 (explaining its experimental method included “lightly doped silicon substrate that has identical planer dopant diffusions with thermal oxide passivation on both sides of the wafer.”); EX1015, 4:45-62 (disclosing “[s]hallow diffused regions 60 and 62 are formed in the opposing surfaces of the wafer by the diffusion of an N type

dopant . . . [and] silicon oxide layers 64 and 66 are then formed on the surfaces of substrate 50.”); EX1035, 822 (annotated figure below, left); EX2001, ¶89.

Swanson-352 discloses that its silicon oxide layers were on the order of 175 nm thick. *See* EX1015, 4:61-66, FIGs. 5 and 7 (below). In contrast, Li does not disclose using a passivation oxide layer on the front side of its substrate 508. *See* EX1005, FIG. 5E (annotated below, right); EX2001, ¶89.



EX1015, FIGs. 5, 7.

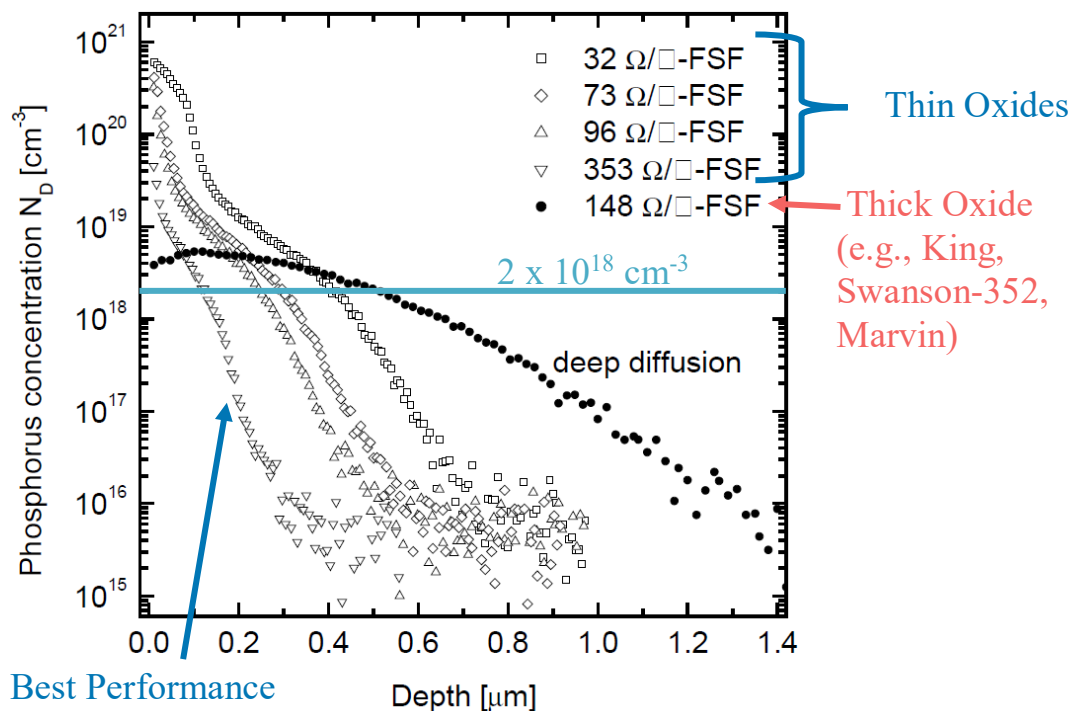


EX1035, FIG. 1 (excerpted).

EX1005, FIG. 5E (annotated).

CSI ignores the differences in the solar cell structures between Li and the cited references and provides no explanation of how or whether the presence of the silicon oxide passivation layer in King, Swanson-352, and Marvin would affect doping concentrations—but Granek and Muller do.

Nearly 20 years later, Granek shows a correlation between the thickness of the silicon oxide passivation layer and the dopant concentration on the front side of the substrate. EX2001, ¶91. Granek analyzes similar solar cell performance characteristics as King did, comparing the results of “thin thermal oxides” (i.e., 2007 technology) against a “thick 105 nm antireflection oxide passivation” (i.e., 1990s technology in King, Swanson-352, and Marvin). EX2015, 2. Granek plots dopant profiles for different dopant concentrations using a thin 10 nm thermal oxide passivating layer (unfilled shapes $\square$, $\diamond$, $\triangle$, ∇) and one dopant profile for a thick 105 nm oxide passivation (filled shape $\bullet$). *See id.*, 2, FIG. 4 (annotated below).



EX2015, FIG. 4 (annotated).

Granek confirmed that lower saturation current densities were possible using thin thermal oxide passivation layers and high surface dopant concentrations rather than thick oxide passivation. *See id.*, 5 (Table II annotated below).

Table II. Summary of the results for the textured samples with different front surface field diffusions.

	$\rho_{base} = 1 \Omega \text{ cm}$ low-level-injection			$\rho_{base} = 10 \Omega \text{ cm}$ high-level-injection	
	n^+ diffusion [$\Omega/\text{sq.}$]	J_{0s} [fA/cm ²]	$V_{OC, Limit}$ [mV]	J_{0s} [fA/cm ²]	$V_{OC, Limit}$ [mV]
Thin Oxides	32	1170	615	1180	615
	73	290	651	296	651
	96	138	671	161	667
	353	31	710	36	706
	148 (deep)	38	705	40	703
	no diffusion	27	714	31	710

Thick Oxide
(e.g., King,
Swanson-352,
Marvin)

EX2015, Table II (annotated).

Accordingly, Granek's proposed dopant concentration for producing a front surface field was much higher than Swanson-352 and required a different thickness of oxide passivation layer to be used. EX2001, ¶¶91-93. At a minimum, Granek proves that "front surface doping concentration" is dependent on the thickness of the front side oxide passivation layer and that it was not settled in 1990. *Id.* Moreover, Muller shows adopting thin silicon oxide layers with "quite strong doping on the front side" that created a front surface field capable of suppressing UV-illumination degradation and improving long term UV-stability of the

passivation. EX1008, 267-270 (~10 nm thick thermal oxide used in experimentation); EX2015, 3 (same).

In view of the above, it would *not* have been obvious to a Skilled Artisan at the time of the '315 patent invention to adopt design parameters for solar cell structures from the 1990s (such as those solar cell structures disclosed by King, Swanson-352, and Marvin) known to have issues with “long term UV-stability of the passivation” and that were no longer in use. *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.”). EX2001, ¶94. Moreover, it would not have been obvious to a Skilled Artisan to adopt King, Swanson-352, and Marvin’s front surface doping concentrations, which are tied to front side oxide passivation layers, where Li does not disclose such a layer. *Id.* CSI fails to address these stark differences and show why it would have been obvious to modify Li’s solar cell configuration based on the incompatible solar cell teachings of King, Swanson-352, and Marvin.

b. King, Swanson-352, and Marvin do not disclose an “optimum” dopant concentration.

CSI’s statement that “[b]y December 22, 2014, it had been known for decades that the front portion formed in the silicon substrate of a back-contact solar cell should be optimally doped at a concentration of approximately $2 \times 10^{18} \text{ cm}^{-3}$ or less” is demonstrably false. Pet., 17-18. Marvin alone contradicts CSI’s position,

disclosing two different doping concentrations based on a solar radiation environment. *See* EX1035, 826-27 (recommending a doping concentration of $5 \times 10^{18} \text{ cm}^{-3}$ for terrestrial environments and $1 \times 10^{18} \text{ cm}^{-3}$ for high-radiation environments); EX2001, ¶95. CSI cherry-picks a front surface doping recommendation of $1 \times 10^{18} \text{ cm}^{-3}$ for a solar cell intended for use in space (i.e., a high-radiation environment) and argues that “Marvin’s focus on high radiation environments, such as space, would not have deterred the Skilled Artisan from combining with Li because Li does not limit its back-contact solar cell to low radiation or terrestrial environments.” Pet., 35. But CSI misses the point: an “optimum” dopant concentration will vary based on design parameters. *See* EX1035, 827 (“The light intensity to be used and the radiation environment affect the [Interdigitated Back Contact cell] design to a greater extent than in conventional cells.”); EX2001, ¶95.

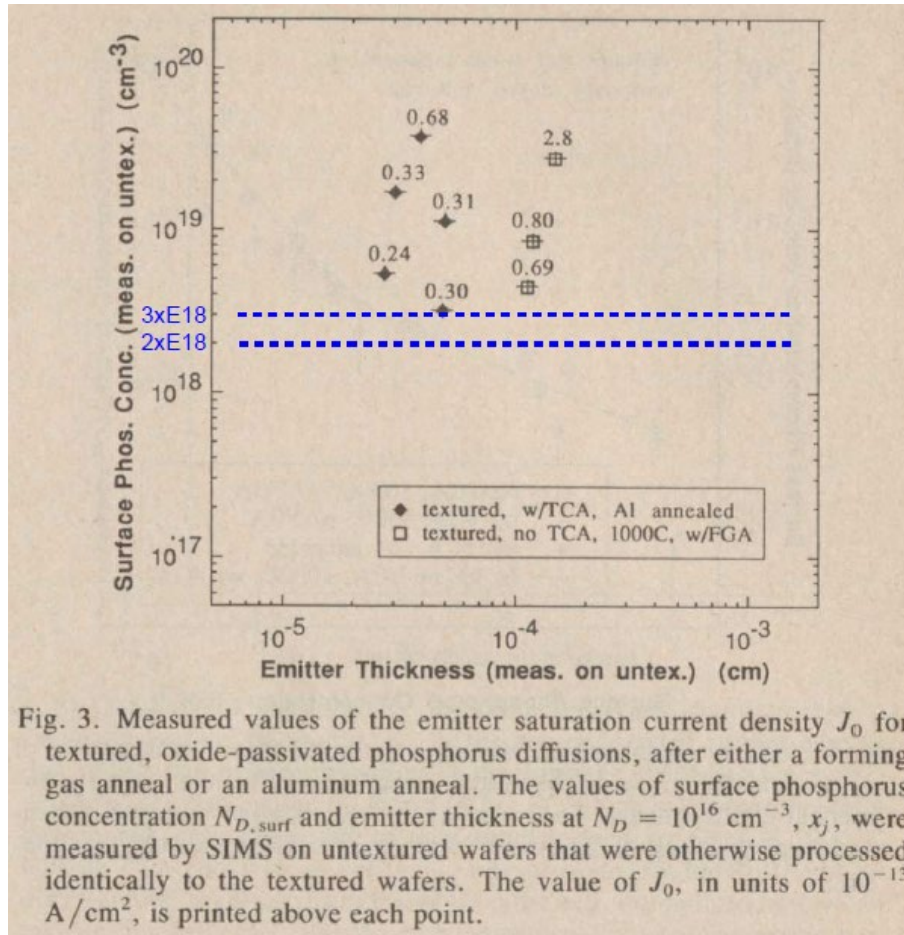
Similarly, Swanson-352 discloses a photovoltaic cell designed for a high-radiation environment:

The means for receiving *concentrated radiation* includes a housing having a radiation receiving window, a secondary concentrator defined by walls of the housing within the window, and a chamber for confining the concentrated radiation. A radiator element may be positioned within the chamber for receiving the concentrated radiation, and the photovoltaic cell is positioned within the chamber in

close proximity to the radiator element for receiving radiated energy from the radiator.

EX1015, 2:13-22. Thus, like Marvin, Swanson-352's disclosure of a "surface dopant concentration" of $1 \times 10^{18} \text{ cm}^{-3}$ is indicative of the structure and radiation environment of that *particular* solar cell and not an "optimum" doping concentration for any solar cell. *Id.*, 4:49-51; EX2001, ¶96. CSI does not address the fact that Swanson-352 is designed as a concentrator solar cell and fails to explain why a Skilled Artisan would have looked to a solar cell designed for a high-radiation environment to determine an "optimum" dopant concentration in Li. EX2001, ¶97.

Finally, King's conjecture about a surface dopant concentration of $1 \times 10^{18} \text{ cm}^{-3}$ of a passivated emitter being "probably near optimum in [saturation current density] J_0 when [the solar cell] has a textured front surface" appears to be either highly approximated or aspirational. EX1006, 369; EX2001, ¶98. Figure 3 of King does not show any samples near that dopant concentration. *See* EX1006, FIG. 3 (annotated in blue below).



EX1006, FIG. 3 (annotated).

Moreover, CSI makes no attempt to reconcile the disparity of dopant concentrations disclosed in Marvin ($5 \times 10^{18} \text{ cm}^{-3}$ for terrestrial (i.e., one sun) environment) and King, especially in light of the fact that King analyzed a one sun environment. *See* EX1006, 369. CSI fails to show why it would have been obvious to a Skilled Artisan, reading King as a whole, to set an upper limit of dopant concentration for a surface of the substrate where no dopant concentration in King was below that limit. EX2001, ¶99.

Accordingly, CSI's obviousness grounds fail.

2. Grounds 2 and 4: A Skilled Artisan would not have been motivated to combine Li with Muller.

CSI's proposed combination of Li and Muller creates an entirely new solar cell, which would not have been obvious to create without the benefit of hindsight in view of the '315 patent. EX2001, ¶¶100-103. Li only discloses doping the front surface of the substrate by heating substrate 508 "in the presence of a gaseous N-type dopant source." See EX1005, ¶49. In contrast, Muller does not use the gaseous drive-in method disclosed in Li; rather, it uses ion-implanting to achieve "very lowly doped" front surface regions on *n*-type IBC solar cells.

When Muller used an N-type dopant source (e.g., phosphorus) as disclosed in Li to create a front surface field (FSF) profile, it was found that the "[c]ells with FSF degraded strongly under UV-illumination due to the instable SiO₂ passivation on the front side." EX1008, 265. In fact, the degradation was so severe that "[t]he efficiency of FSF cells dropped dramatically by more than 50%." *Id.*, 271. Muller, however, noted that "[t]he degradation of the cells investigated by Granek *et al.* was efficiently suppressed by using a quite strong doping on the front side." *Id.*, 269. Thus, a Skilled Artisan, looking to determine the specific dopant concentration to use for the front-side **N-type** dopant region 520 disclosed in Li, would have concluded from Muller that using an extremely weak doping concentration (i.e., $< 2 \times 10^{18} \text{ cm}^{-3}$) would fail and that a "quite strong doping" should be considered. *Id.*; EX2001, ¶101. In other words, a Skilled Artisan would

have understood that Muller teaches away from using a low doping concentration for the front-side N-type dopant region 520 in Li. EX2001, ¶101.

Having failed to show a suitable dopant concentration for the front-side N-type dopant region 520 in Li, CSI proposes to significantly modify Li's solar cell to replace Li's diffused front-side N-type dopant region 520 with Muller's floating front emitter ("FFE"). As Muller discloses ion implanting the front surface region with a **P-type** dopant source (e.g., boron) to create the FFE, EX1008, 265, CSI proposes "insert[ing] Muller's ion-implanted boron FFE process steps for the front side" of Li's solar cell, Pet., 67. This would involve the following additional processing steps:

- Adding an ion-implanting process, Pet., 63;
- Changing the polarity of the n-type doped portion 520 formed by a gaseous dopant process disclosed by Li and replacing it with a p-type doped portion formed by ion-implanting boron, *id.*;
- Adding "aluminum oxide and silicon nitride passivation" layers not disclosed by Li, *id.*;
- Reversing the order of fabrication disclosed by Li to ion-implant the front dopant regions first, instead of last, *id.*, 67; and
- Masking the backside to diffuse the trench region, *id.*

It is evident that CSI's proposed combination of Li and Muller creates an entirely new solar cell, which would not have been obvious to create without the benefit of hindsight in view of the '315 patent. EX2001, ¶103. Moreover, it would not have been obvious to combine Li and Muller because CSI's proposed modification of Li's fabrication process increases the number of processing steps, which expressly contradicts Li's objective to achieve "a reduction in the sheer number of process operations." EX1005, ¶24; EX2001, ¶103.

Accordingly, CSI's obviousness grounds fail.

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 a parallel district court action in the United States District Court for the Eastern District of Texas. *See Maxeon Solar Pte. Ltd. v. Canadian Solar, Inc.*, No. 2:24-CV-00210-JRG (E.D. Tex. Mar. 25, 2024). The PTAB considers six non-exclusive factors in making its determination:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court's trial date to the PTAB's projected statutory deadline for a final written decision;

3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the PTAB's exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 6 (PTAB Mar. 20, 2020)

(precedential). As explained below, 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. Thus, evaluating the *Fintiv* factors as a whole, the Board should deny institution.

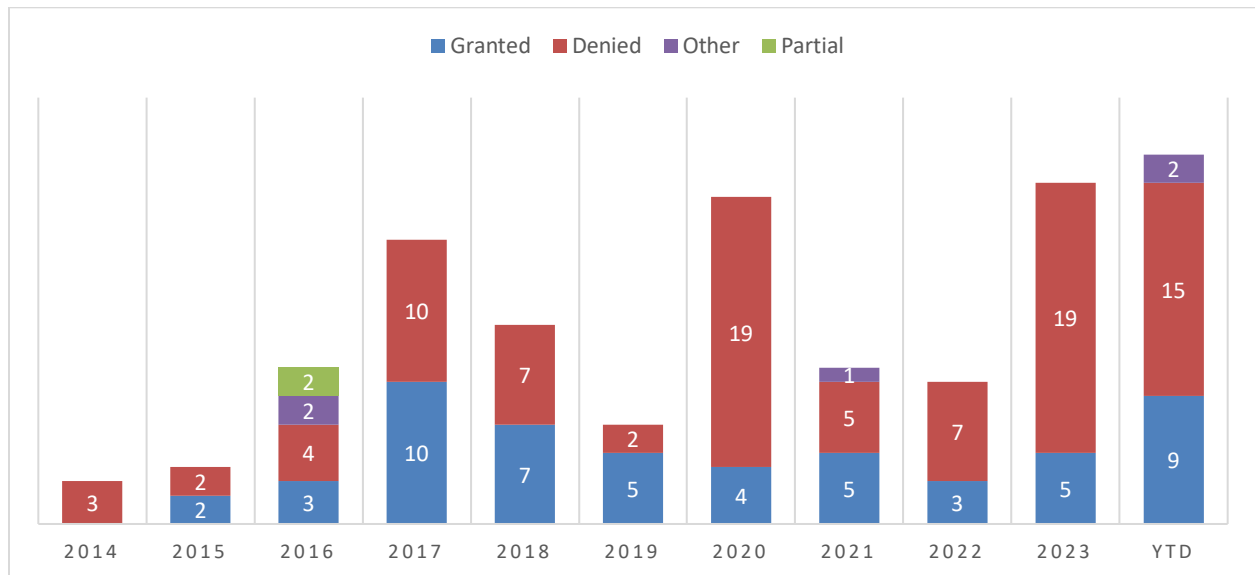
A. *Fintiv* Factor 1 is neutral: No stay has been requested or granted in the district court proceeding.

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 has filed a motion to stay with the district court. Consequently, this factor remains neutral.

CSI suggests that a stay is likely, which is wrong and, in fact, misleading. CSI states that “Judge Gilstrap has frequently granted stays based on instituted

IPRs . . . [with] at least 48 stays granted[] [and] only 41 denied *with prejudice*.”

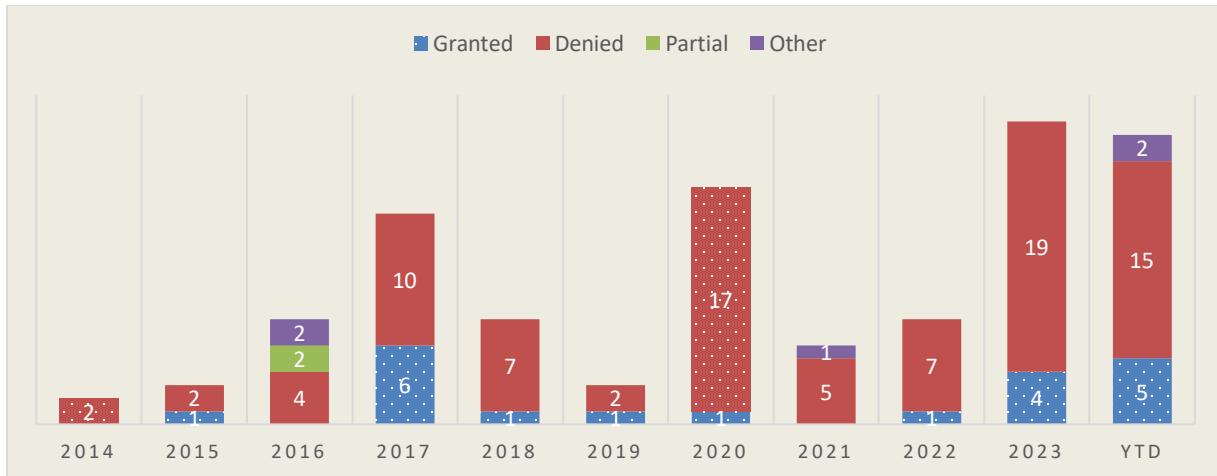
Pet., 9. But CSI’s statistics cherry-pick only certain decisions (e.g., leaving out motions denied without prejudice). Taking *all* of Judge Gilstrap’s denials (i.e., both those that are denied with and without prejudice) into consideration, a party’s success rate on a motion to stay pending IPR is only on average 36%.



Motion to Stay Pending *Inter Partes* Review Success by Year
(Gilstrap, J. – E.D. Tex.)⁹

Further, if the motions to stay that were agreed or stipulated to by the parties are omitted from the data set, a party’s success rate before Judge Gilstrap plummets to 16%.

⁹ Results charted from DocketNavigator.com Document Search, run on October 8, 2024, for Motion to Stay Pending *Inter Partes* Review decided by Judge Rodney Gilstrap. See EX2004.



Opposed Motion to Stay Pending *Inter Partes* Review
Success by Year (Gilstrap, J. – E.D. Tex.)¹⁰

Thus, CSI’s implication that a stay is likely in Judge Gilstrap’s court is not supported by the data.

Regardless, the PTAB 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). Nor could the PTAB infer how the District Court would rule in this particular case, as CSI provided no facts or analysis alleging to show that it would prevail under the district court’s three-factor test for determining whether to grant a stay. *See NFC Tech. LLC v. HTC Am., Inc.*, No. 2:13-cv-1058-

¹⁰ Results charted from DocketNavigator.com Document Search, run on October 8, 2024, for Motion to Stay Pending *Inter Partes* Review decided by Judge Rodney Gilstrap with “Stipulated/Agreed” motions removed. *See* EX2005.

WCB, 2015 WL 1069111, at *2 (E.D. Tex. Mar. 11, 2015) (analyzing “(1) whether the stay will unduly prejudice the nonmoving party, (2) whether the proceedings before the court have reached an advanced stage, including whether discovery is complete and a trial date has been set, and (3) whether the stay will likely result in simplifying the case before the court”).

At bottom, this factor is neutral.

B. *Fintiv* Factor 2 is neutral: Trial is scheduled within two weeks of the PTAB’s final written decision deadline.

This factor assesses the proximity of the district court’s trial date to the PTAB’s projected statutory deadline for a Final Written Decision. *Fintiv*, IPR2020-00019, Paper 11 at 6. Here, the district court issued a Docket Control Order setting trial for January 26, 2026. *See* EX2008. The projected statutory deadline for the PTAB’s final written decision is three days later on January 29, 2026. Although the Director’s Guidance Memo¹¹ acknowledges that a court’s scheduled trial date may not be “a good indicator of whether the district court trial

¹¹ Director’s Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) (“Guidance Memo”), *available at* https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621.pdf.

will occur before the statutory deadline for a final written decision,” the median time from filing to trial in the Eastern District of Texas averages 19.7 months over the last 6 years, and the most recent data shows 21.6 months.¹² *See* EX2006 (Federal Court Management Statistics (June 30, 2024)) (excerpts below).

			12-Month Periods Ending					
			Jun 30 2019	Jun 30 2020	Jun 30 2021	Jun 30 2022	Jun 30 2023	Jun 30 2024
Median Time (Months)	From Filing to Disposition	Criminal Felony	9.6	11.6	13.1	14.7	20.6	23.9
		Civil ²	8.6	9.2	8.1	8.8	8.5	7.6
	From Filing to Trial ² (Civil Only)		17.5	17.7	20.4	24.5	16.7	21.6

United States District Court – Judicial Caseload Profile (EDTX),
EX2006, 35 (excerpts).

This median timing is consistent with the current trial date set in the EDTX proceeding. Maxeon filed its case on March 25, 2024, making the currently set trial date more than twenty-two months from filing. Accordingly, there is no reason to believe that this trial date will not hold. Given the close proximity between the district court’s trial date and the projected deadline for the PTAB’s Final Written Decision, *Fintiv* factor 2 is neutral. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 15 (PTAB Dec. 1, 2020) (precedential) (finding factor

¹² Although the court had not yet set a trial date at the time of the Petition, CSI also ignores the median time to trial data.

2 neutral because “trial [was] scheduled to begin around the same time as [the PTAB’s] deadline to reach a final decision”).

C. *Fintiv* Factor 3 favors denial: 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. *Fintiv*, Paper 11 at 11.

By the time the PTAB issues its Institution Decision in January 2025, the parties will have spent considerable resources in the parallel district court action. As of the filing of this paper, the parties have already exchanged infringement and invalidity contentions, served and responded to written discovery requests, and served substantial document productions. Specifically regarding discovery, the parties have exchanged over fifteen letters and emails concerning various issues, including issues related to CSI’s invalidity claims. Each party has also served a third-party subpoena on Maxeon’s corporate predecessor, SunPower Corporation, seeking documents and testimony related to CSI’s invalidity claims. Maxeon also filed a combined motion to dismiss CSI’s inequitable conduct counterclaim and to strike CSI’s inequitable conduct defense, which the court denied as moot after CSI amended its counterclaims and defenses to withdraw its counterclaim and defense. *See* EX2007.

The facts here are similar to those in *Sand Revolution II, LLC v. Continental Intermodal Group — Trucking LLC*, where *Fintiv* factor 3 did not weigh against exercising discretion to deny institution despite that “fact discovery [was] still ongoing, expert reports [were] not yet due, and substantive motion practice [was] yet to come.” IPR2019-01393, Paper 24 at 10-11 (PTAB June 16, 2020) (informative). There, the parties had exchanged infringement and invalidity contentions, and the district court had invested resources “relat[ing] to ancillary matters untethered to the validity issue itself,” such as setting and amending the case schedule and granting several *pro hac vice* motions. *See id.*, 10.¹³ Recognizing that “the district court and the parties have not invested substantially in the merits of the invalidity positions,” the PTAB held that *Fintiv* factor 3 “weighs only marginally, if at all, in favor of exercising discretion to deny institution.” *Id.*, 11. Accordingly here, *Fintiv* factor three likewise weighs in favor of the PTAB exercising its discretion to deny institution, or is at least neutral.

D. *Fintiv* Factor 4 is neutral: The issues raised in the Petition and in the district court overlap completely, and CSI’s stipulation does not prohibit denial.

“*Fintiv* factor four looks at the overlap between the issues raised in the IPR

¹³ To date, the district court has granted three *pro hac vice* motions filed by CSI.

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. CSI asserts the same grounds in its petitions¹⁴ that it asserts in the district court action. *Compare* Pet., 3-4 and IPR2024-01038 Pet., 4-5, *with* EX2009 (“Invalidity Contentions”), 46-61. In fact, the bulk of CSI’s document production accompanying its Invalidity Contentions (as required by P.R. 3-4 (E.D. Tex.)) comprised the very documents and exhibits filed in this proceeding. Alone, this complete overlap of issues strongly weighs in favor of denial. *Fintiv*, IPR2020-00019, Paper 11 at 12; *see also* Guidance Memo (“[i]f 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.”).

The overlap is mitigated only slightly by CSI’s stipulation. CSI has not provided a *Sotera* stipulation. The Guidance Memo states that the PTAB “will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same

¹⁴ CSI challenges claims 10-16 and 19 of the ’315 patent across 2 petitions: claims 10-15 are challenged in the petition filed in IPR2024-01038; and claims 16 and 19 are challenged in this Petition.

grounds or any grounds that could have reasonably been raised before the PTAB.”

Guidance Memo, 3; *see also id.*, 7-8. But here, CSI only stipulates that, “if this IPR is instituted, it will not assert in any district court or ITC litigation that [*any claim at issue in this IPR* is] invalid on the basis of any ground raised or that reasonably could have been raised during this IPR.” Pet., 9. The PTAB has previously determined that this type of stipulation “leaves open the possibility that Petitioner might still raise in the parallel District Court proceeding a ground that it asserted or reasonably could have asserted in the Petition with respect to a claim that is not subject to an instituted *inter partes* review.” *Duplo USA Corp. v. MGI Digital Tech.*, IPR2023-00936, Paper 8 at 14 (PTAB Dec. 5, 2023). The ’315 patent contains 20 claims in total and CSI challenges only claims 10-20. *See* EX1001, 10:8-11:20.

CSI provides no evidence or argument that claims 1-9, 17, 18, and 20 of the ’315 patent—which are not “at issue in this IPR”—could not, or would not, be added to the parallel district court action. Indeed, fact discovery remains open, and it is possible that discovery will reveal facts (e.g., the existence of additional accused products) that enable Maxeon to add these claims to the parallel district court action. Indeed, CSI even acknowledges this second petition was necessitated by Maxeon’s assertion of additional claims in the district court. Pet., 4-7, 9-10. As such, CSI’s stipulation “does not mitigate the risk of duplicative proceedings and

conflicting decisions to the same degree as the stipulation in *Sotera*.” *Duplo*, IPR2023-00936, Paper 8 at 14. Accordingly, CSI’s narrower stipulation does not implicate the Guidance Memo’s prohibition against discretionary denial where a *Sotera*-type stipulation is presented, and this factor does not weigh in favor for or against the PTAB exercising its discretion to deny institution pursuant to § 314(a). *Id.*, 15, 18.

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

CSI is the defendant in the parallel district court action, 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*, IPR2020-01019, Paper 12 at 19; *Sand Revolution II*, IPR2019-01393, Paper 24 at 12-13.

CSI nevertheless argues, contrary to prior Board precedent, that this fact should “weigh[] against denial because it permits CSI to provide the §315 [sic] stipulation . . . thereby avoiding any possibility of duplication.”¹⁵ Pet., 9; *see*

¹⁵ Maxeon assumes CSI intended to cite §314, which provides that institution of review is discretionary. The statute, however, does not provide for the ability of petitioners to stipulate and avoid a discretionary denial under *Fintiv*. The effect of stipulations on the PTAB’s exercise of discretion to deny institution is

Sotera, IPR2020-01019, Paper 12 at 19 (weighing this factor in favor of discretionary denial despite Petitioner’s stipulation); *see also Sand Revolution II*, IPR2019-01393, Paper 24 at 12-13 (same). But CSI’s stipulation does not mitigate the risk of duplicative proceedings and conflicting decisions to the same degree as the stipulation in *Sotera*. *See* Section V.D (*Fintiv* factor 4) *supra*. Further, the Guidance Memo explains that “[p]arallel district court and AIA proceedings involving the same parties and invalidity challenges can increase, rather than limit, litigation costs[, given] . . . the potential for inefficiency and gamesmanship in AIA proceedings.” Guidance Memo, 1.

Thus, this factor favors denial.

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

Fintiv factor 6 considers any other circumstances that impact the PTAB’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

provided solely by Board precedent (e.g., *Sotera*) and the Director’s Guidance Memo.

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, 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.” See IPR2022-01242, Paper 23 at 4 (Feb. 27, 2023) (precedential). As explained above, here *Fintiv* factor 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.*, 3-4 (citing *OpenSky Indus., LLC v. VLSI Tech. LLC*, IPR2021-01064, Paper 102 at 49 (PTAB Oct. 4, 2022) (precedential)). Here, CSI’s Petition fails to meet this higher standard, as it does not present a compelling unpatentability challenge based on the prior art combinations it asserts. As explained in detail above, CSI’s Petition fails to establish that the prior art discloses, teaches, or suggests at least two features—“first emitter region having metal impurities formed over the dielectric region” and “dopant concentration of approximately less than or equal to $2 \times 10^{18} \text{ cm}^{-3}$ ”—of independent claim 10 and at least one feature—“second emitter region having

metal impurities formed over the dielectric region”—of dependent claim 16. CSI’s attempt to show “metal impurities” are inherently present in Li’s “emitter regions” based on the teachings of Hu, Ramappa, and Liu-2 is flawed and speculative, as these references provide contradictory and irreconcilable teachings. CSI’s repackaging of Hu and Ramappa as an obviousness combination fares no better given that Hu’s oxide layer is a barrier to gettering and Ramappa’s oxide layer acts as an impurity sink.

Also, CSI’s obviousness argument to show that Li in combination with other references teaches the “dopant concentration” fails for at least two reasons. First, CSI does not assert a sufficient motivation to combine Li’s non-oxide passivated solar cell with the incompatible oxide passivated solar cells of King, Swanson-352, and Marvin that are known to have reliability issues. Second, CSI’s proposed modification of Li based on Muller’s different ion implantation process expressly contradicts Li’s objective for a streamlined solar cell fabrication process.

For at least these reasons, CSI’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, CSI fails to show a reasonable likelihood that any of the Challenged Claims is unpatentable in view of the cited art. Maxeon, therefore, respectfully requests that the Board deny institution.

Respectfully submitted,

VINSON & ELKINS LLP

A handwritten signature in black ink, reading "Eric J. Klein". The signature is written in a cursive, flowing style.

Eric J. Klein

Registration No. 51,888
Lead Attorney for Patent Owner

Date: October 29, 2024

2001 Ross Avenue, Suite 3900
Dallas, TX 75201
(214) 220-7700

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 11,688 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

2. This Patent Owner Preliminary Response complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman font.

Respectfully submitted,

VINSON & ELKINS LLP

A handwritten signature in black ink, appearing to read "Eric J. Klein". The signature is written in a cursive, flowing style.

Eric J. Klein

Registration No. 51,888
Lead Attorney for Patent Owner

Date: October 29, 2024

2001 Ross Avenue, Suite 3900
Dallas, TX 75201
(214) 220-7700

CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e))

I certify that the above-captioned **PATENT OWNER PRELIMINARY RESPONSE UNDER 37 C.F.R. § 42.107(a)** and associated Exhibits 2001, 2004-2009, and 2015-2018 were served in their entireties on October 29, 2024, upon the following parties via electronic mail:

Samuel N. Tiu (Lead Counsel)
Joseph A. Micallef (Back-Up Counsel)
Brooke S. Böll (Back-Up Counsel)
SIDLEY AUSTIN LLP
Sidley_CSI_IPR@sidley.com
stiu@sidley.com
jmicallef@sidley.com
brooke.boll@sidley.com

Respectfully submitted,

VINSON & ELKINS LLP



Eric J. Klein
Registration No. 51,888
Lead Attorney for Patent Owner

Date: October 29, 2024

2001 Ross Avenue, Suite 3900
Dallas, TX 75201
(214) 220-7700