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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

SIONYX, LLC,
Patent Owner.

Case IPR2025-00164
Patent 9,064,764 B2

PATENT OWNER'S PRELIMINARY RESPONSE

37 C.F.R. § 42.107 and 35 U.S.C. § 313

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LIST OF PATENT OWNER'S EXHIBITS

PO Exhibit Number	Description
	Filed and Served on March 5, 2025 with Patent Owner's Motion for <i>Pro Hac Vice</i> Admission of Andrew P. Zappia Under 37 C.F.R. § 42.10
2001	Declaration of Andrew P. Zappia in Support of Patent Owner's Motion for <i>Pro Hac Vice</i> Admission
	Filed and Served on April 21, 2025 with Patent Owner's Preliminary Response
2002	Redacted Witness Statement of Dr. Dean Neikirk filed in <i>In the Matter of Certain Sensors With Pixels And Products Containing The Same</i> , Inv. No. 337-TA-1403 (ITC) ("Neikirk Witness Statement")
2003	Declaration of Dr. Adam Fontecchio in Response to Declaration of Dr. Daniel Foty Concerning Claim Construction for Certain Terms in U.S. Patent Nos. 9,064,764, 9,905,599, 10,224,359, 11,069,737, and 11,721,714 dated September 20, 2024 in <i>In the Matter of Certain Sensors With Pixels And Products Containing The Same</i> , Inv. No. 337-TA-1403 (ITC) ("Fontecchio Claim Construction Decl.")
2004	"Understanding Wavelengths in Fiber Optics, found at https://www.thefoa.org/tech/wavelength.htm , last accessed April 21, 2025 ("FOA Reference Guide")

CLAIM LISTING FOR U.S. PATENT NO. 9,064,764

1. **[1Preamble]** A light trapping device, comprising:
 [1a] at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface,
 [1b] and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;
 [1c] a backside light trapping material substantially covering the backside surface; and a peripheral light trapping material substantially covering the peripheral sidewall,
 [1d] wherein at least one of the backside light trapping material and the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials,
 [1e] wherein at least one of the two low refractive index materials is doped with a dopant to create a surface field,
 1[f]: and wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.
2. The device of claim 1, wherein the backside light trapping material and the peripheral light trapping material includes a high refractive index material sandwiched between two low refractive index materials.

3. The device of claim 1, wherein the dopant is boron or antimony.
4. The device of claim 1, wherein the peripheral sidewall extends completely around the pixel periphery.
5. The device of claim 1, wherein the peripheral sidewall extends from the light incident surface to the backside surface.
6. The device of claim 1, wherein at least one of the backside light trapping material and the peripheral light trapping material is a metal layer.
7. An array of light trapping pixel devices of claim 1.
8. **[8Preamble]** A light trapping device, comprising:
 - [8a]:** at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;
 - [8b]:** a backside light trapping material substantially covering the backside surface;
 - [8c]:** and a peripheral light trapping material substantially covering the peripheral sidewall,
 - [8d]:** wherein at least one of the backside light trapping material and the peripheral light trapping material includes a first material sandwiched

between two second materials, wherein the first material has a higher refractive index as compared to the two second materials,

[8e]: and wherein the difference in refractive index between the first material and the two second materials is at least 0.2,

[8f]: and wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.

9. The device of claim 8, wherein the two second materials have a refractive index of less than about 2.1.

10. The device of claim 9, wherein at least one of the two second materials includes a member selected from the group consisting of an oxide, a nitride, oxynitrides, a gas, at least a partial vacuum, and combinations thereof.

11. The device of claim 9, wherein the at least one of the two second materials includes a member selected from the group consisting of silicon oxide, silicon nitride, silicon dioxide, and combinations thereof.

12. The device of claim 8, wherein the first material includes a material having a refractive index of greater than or equal to about 2.1.

13. The device of claim 12, wherein the first material includes a member selected from the group consisting of polycrystalline silicon,

amorphous silicon, single crystal silicon, multicrystalline silicon, nanocrystalline silicon, germanium, and combinations thereof.

14. The device of claim 8, wherein the peripheral sidewall extends completely around the pixel periphery.

15. The device of claim 8, wherein the peripheral sidewall extends from the light incident surface to the backside surface.

16. The device of claim 8, wherein at least one of the backside light trapping material and the peripheral light trapping material is a metal layer.

17. **[17Preamble]** A light trapping device, comprising:

[17a] at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;

[17b] a backside light trapping material substantially covering the backside surface;

[17c] and a peripheral light trapping material substantially covering the peripheral sidewall,

[17d] wherein at least one of the backside light trapping material and the peripheral light trapping material has a sloped surface at the pixel device interface,

[17e] and wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.

18. The device of claim 17, wherein the peripheral sidewall extends completely around the pixel periphery.

19. The device of claim 17, wherein the peripheral sidewall extends from the light incident surface to the backside surface.

20. The device of claim 17, wherein at least one of the backside light trapping material and the peripheral light trapping material is a metal layer.

21. **[21Preamble]** A light trapping device, comprising:

[21a] at least one light sensitive pixel having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery;

[21b] a backside light trapping material substantially covering the backside surface;

[21c] a peripheral light trapping material substantially covering the peripheral sidewall;

[21d] and a textured layer positioned to interact with light proximal to the backside surface,

[21e] wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.

22. The device of claim 21, wherein the textured layer is located between the backside surface and the backside light trapping material.

23. The device of claim 21, wherein the peripheral sidewall extends completely around the pixel periphery.

24. The device of claim 21, wherein the peripheral sidewall extends from the light incident surface to the backside surface.

25. The device of claim 21, wherein at least one of the backside light trapping material and the peripheral light trapping material is a metal layer.

EX1001 ('764 Patent), 17:60-20:26.

I. INTRODUCTION

Pursuant to 37 C.F.R. § 42.107(a) and 35 U.S.C. § 313, SiOnyx, LLC (“Patent Owner”) submits this Preliminary Response to the Corrected Petition for *Inter Partes* Review (“Petition”, Paper 3) of claims 1-25 (the “Challenged Claims”) of U.S. Patent No. 9,064,764 (EX1001) (“the ’764 Patent”) filed by Samsung Electronics Co., Ltd. (“Petitioner”) on November 29, 2024, with a filing date accorded of November 29, 2024 (Paper 6) and notice mailed on January 21, 2025. This Preliminary Response is timely filed.

It is Petitioner's burden to show — by the Petition and its supporting evidence — that there is a reasonable likelihood that at least one of the Challenged Claims (defined below) is unpatentable. *See* 37 C.F.R. § 42.108(c); *see also* 35 U.S.C. § 314(a). For the reasons discussed below, Petitioner has failed to meet this burden.

As an initial matter, Patent Owner's arguments for discretionary denial under Section 314(a) will be submitted through a separate brief as instructed by the March 26, 2025 Memorandum (the “Memorandum”) from the United States Patent

and Trademark Office on discretionary denial.¹ See Memorandum Regarding Interim Processes for PTAB Workload Management (Mar. 26, 2025).

Even if discretionary denial were not warranted, the Petition fails on the merits. As discussed below, because Petitioner is unable to meet its burden of showing that the Hwang reference discloses “at least one light sensitive pixel having ... a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery” (EX1001 ('764 Patent), 17:61-65, 18:29-33, 19:8-12, 20:2-6) or that the Yamada reference discloses “at least one light sensitive pixel” (EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2), Petitioner fails to show the independent claims are invalid.

¹ The Memorandum instructs Patent Owners to file a brief separate from the Patent Owner Preliminary Response to seek discretionary denial, within two (2) months of the date of entry of the Notice of Filing Date Accorded to Petition in IPR proceedings. The Memorandum further provides that if the two (2) month time period expired before the issuance of the Memorandum, a Patent Owner may file its brief seeking discretionary denial within one (1) month following the issuance of the Memorandum. In this proceeding, the two (2) month time period expired on March 21, 2025, so the due date for Patent Owner's submission on discretionary denial is April 26, 2025.

II. SUMMARY OF ARGUMENTS

Petitioner has failed to meet its burden to show a reasonable likelihood that at least one of the Challenged Claims is unpatentable over: (i) Hwang² alone or in combination with Konno and/or Mori; or (ii) Yamada alone or in combination with Schubert and/or Mori.

Each of the independent claims – claims 1, 8, 17 and 21 – includes the same limitations of “at least one light sensitive pixel having...a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery” (the “Limitations”). Under all of the Grounds, the Petition relies solely on either Hwang or Yamada to meet these Limitations. However, Petitioner has not presented arguments sufficient to show invalidity of at least these Limitations under anticipation or obviousness.

First, in Grounds 1 to 4 concerning the above Limitations, Petitioner relies solely on disclosures from Hwang, under theories of anticipation or obviousness (claim 8) and obviousness (claims 1, 17, and 21). To support its anticipation theory, Petitioner must make unsupported assertions as to what the Hwang reference teaches. Specifically, Petitioner fails to show that Hwang discloses the

² To the extent not defined herein, defined terms used herein have the same meaning as ascribed to them in the Corrected Petition (Paper 3).

Limitations, *i.e.*, (i) “at least one light sensitive pixel”; or (ii) “a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery” because Petitioner relies on a structure disclosed in Hwang that does not meet these Limitations. Petitioner's assertions not only find no intrinsic support in Hwang, but in fact they contradict express teachings in Hwang. Petitioner's failure to show these elements in Hwang removes Hwang as a viable anticipatory reference. As a result, the Petition fails to establish anticipation of claim 8 by Hwang.

For obviousness, the Petition simply fails to present the proofs necessary to support an obviousness theory. To support anticipation, Petitioner asserts that Hwang's figures (and the discussion thereof), “teach or suggest” the above Limitations of claims. That is false, as noted herein, but that is Petitioner's position. If Petitioner then wanted to migrate to an obviousness theory, it needed to explain what in the Limitations are not in Hwang, and then set forth why a person of ordinary skill in the art (“POSITA”), would have been motivated to modify or augment Hwang's teachings in a manner that would render the Limitations obvious, with a reasonable expectation of success.

The Petition does not identify where the express disclosures in Hwang might be lacking, or why a POSITA would have been motivated to modify or augment Hwang in a manner that matches these Limitations, which are in each of the

Challenged Claims (without hindsight). Petitioner also fails to address why there would have been a reasonable expectation of success in any such exercise. It appears Petitioner believes it should be accorded an obviousness determination by default if the Board questions its anticipation position.

Regarding independent claims 1, 8, 17 and 21, for Grounds 5 to 8 Petitioner relies on Yamada as disclosing the limitation “at least one light sensitive pixel,” (EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2). However, Petitioner has not demonstrated that Yamada discloses an image sensor. Therefore, Petitioner's obviousness assertions based on Yamada fail.

Therefore, institution should be denied.

III. PETITIONER'S GROUNDS

Petitioner proffers eight (8) Grounds for attacking the Challenged Claims (claims 1-25):

Ground	[Petition] Challenged Claims	Basis for Rejection
1	8-15	§102 / §103: Hwang (EX1005)
2	16-25	§103: Hwang (EX1005) and Konno (EX1010)
3	1-5, 7	§103: Hwang (EX1005) and Mori (EX1006 / EX1007)
4	6	§103: Hwang (EX1005), Mori (EX1006 / EX1007), and Konno (EX1010)
5	8, 12, 14-16	§103: Yamada (EX1011 / EX1012)
6	8-11, 13	§103: Yamada (EX1011 / EX1012) and Schubert (EX1013)

Ground	[Petition] Challenged Claims	Basis for Rejection
7	1-7	§103: Yamada (EX1011 / EX1012), Schubert (EX1013), and Mori (EX1006 / EX1007)
8	17-25	§103: Yamada (EX1011 / EX1012) and Konno (EX1010)

See Petition, 2-3.

As discussed below, Petitioner has failed to meet its burden to show a reasonable likelihood that at least one of the Challenged Claims is unpatentable under these Grounds.

IV. INSTITUTION SHOULD BE DENIED IN LIGHT OF PETITIONER'S FAILURE TO ESTABLISH ANTICIPATION OR OBVIOUSNESS BASED ON HWANG OR YAMADA

A. Ground 1: Hwang (EX1005)

Across Grounds 1 through 4, Petitioner argues, but fails to establish, that Hwang discloses “at least one light sensitive pixel,” (EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2), which limitation is central to all claims of the '764 Patent. Petition, 8-12. Nor does Petitioner establish “a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery”, which is also required in all the independent claims of the '764 Patent. EX1001 ('764 Patent), 17:63-65, 18:31-33, 19:10-12, 20:4-6.

1. Hwang Does Not Disclose “at least one light sensitive pixel”

Petitioner has not demonstrated that Hwang discloses “at least one light sensitive pixel.” EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2. Petitioner's invalidity theory relies on Hwang's “pixel semiconductor pattern 110a” as teaching or suggesting “at least one light sensitive pixel.” However, Petitioner provides unsubstantiated and contradictory evidence that the “pixel semiconductor pattern 110a” in Hwang is the same as the claimed pixel.

Petitioner has consistently admitted that a pixel converts light into an electrical signal. EX1025 (ITC Markman Order), 22. However, Petitioner fails to submit evidence that Hwang's “pixel semiconductor pattern 110a” is the component in Hwang that converts light into an electrical signal. Instead, Petitioner and its expert Dr. Lebby identify the photodiode 145 in Hwang as the structure that converts light into an electrical signal. Petition, 8 at fn. 4. Petitioner attempts to sidestep this inconsistency by conflating elements in Hwang's description, rather than addressing just what is the “pixel semiconductor pattern 110a” in Hwang. EX1003 (Lebby Decl.), ¶¶64, 65, fn. 5. These arguments by Petitioner and Dr. Lebby, which contradict the actual teachings of Hwang, cannot support Petitioner's positions.

Petitioner does not demonstrate that Hwang's “pixel semiconductor pattern 110a” is a pixel. Hwang's inventors clearly knew the term “pixel,” as the

specification uses that word both as part of the longer phrase “pixel semiconductor pattern” and in the context of generally describing image sensors. *See, e.g.*, EX1005 (Hwang), 1:55-57 (“In accordance with aspects of the present invention also provided is an image sensor capable of minimizing interference between neighboring pixels.”). To interpret “pixel semiconductor pattern 110a” as equivalent to “pixel” renders two of the three words in that phrase meaningless, and ignores the inventor’s clear lexicography. Petitioner provides no explanation for why Hwang uses two different terms: (i) “pixel semiconductor pattern 110a” and (ii) “pixel.” Instead, both Petitioner and Dr. Lebby simply assume the two terms are synonymous.

Petitioner’s argument is further undermined by the contradictions between its experts’ statements and Petitioner’s claim construction positions. The parties agreed on the function of a pixel. In his claim construction holding, the ITC Administrative Law Judge noted that “Samsung further notes that ‘[b]oth parties’ experts agree that the ‘pixel’ converts light into electrical signals and that the photodiode is the structure that performs this conversion.’” EX1025 (ITC Markman Order), 22 (internal citation omitted). Moreover, Petitioner’s ITC invalidity expert, Dr. Neikirk, states:

At the heart of a CMOS image sensor lies an array of light-sensitive pixels, each of which has a photodiode capable of detecting light. A photodiode converts incoming photons into electrons and holes (i.e., charge carriers).

EX2002 (Neikirk Witness Statement), A33. Dr. Neikirk's description of a pixel confirms Petitioner's position that a pixel converts light into electrical signals. In view of the above, Dr. Lebby's insistence that the "pixel semiconductor pattern 110a" is a pixel is at odds with: (i) Petitioner's own representations at the ITC; (ii) the parties' agreements; and (iii) the findings of the ALJ at the ITC. Indeed, Hwang explains that "photodiode 145" converts light into an electrical signal, not "pixel semiconductor pattern 110a."

Hwang further confirms this when it states that "photodiodes 145 are doped at a low concentration, so that most or the entirety of the photodiodes 145 become depletion regions." EX1005 (Hwang), 6:4-6. The depletion region is the portion of a photodiode where absorbed light generates photocurrent. *See, e.g.*, EX1005 (Hwang), 1:26-29 ("When external light is incident on a depletion region in the photodiode, electron-hole pairs are generated, and the external light is converted to electrical signals."). According to Hwang's explicit description, light is converted to electrical signals only in photodiode 145.

Hwang's description of its depletion region is consistent with the rest of the specification. For example, Hwang's figures show a microlens positioned over "photodiode 145" such that incident light will be focused onto the depletion region. *See, e.g.*, EX1005 (Hwang), Fig. 2; *see also, e.g.*, EX1005 (Hwang), 8:18-19 ("a micro lens 230 **that covers the photodiode 145** is disposed on the color filter") (emphasis added). Critically, the microlens does not extend over the "pixel semiconductor pattern 110a." The limited coverage of Hwang's microlens confirms that Hwang's "pixel semiconductor pattern 100a" is not a pixel. If the entire "pixel semiconductor pattern 110a" could convert light into an electrical signal, the microlens would be configured to focus incident light into the entire "pixel semiconductor pattern 110a," not just into the photodiode.

Dr. Lebby's attempts to explain away this inconsistency further muddy the waters. Dr. Lebby's solution to the contradictory positions taken by Petitioner is to argue, once again, that while Hwang's inventors used specific technical language, they actually meant something different. Specifically, Dr. Lebby states:

While Hwang calls element 145 a "photodiode," a POSITA would understand that term, (i.e., the structure that converts light into an electrical signal) encompasses more than just element 145, and would further include the surrounding pixel semiconductor patterns 110a.

EX1003 (Lebby Decl.), ¶65 at fn. 5. Dr. Lebby's position relies on interpretations of Hwang's specification inconsistent with Hwang's plain language and explicit disclosure. For Dr. Lebby's argument to prevail, the Board must accept that Hwang intended (i) "pixel semiconductor pattern 110a" to mean "pixel," and (ii) the disclosed "photodiode" is not the actual photodiode, rather the actual photodiode includes both the "photodiode" and other components that make up the "pixel semiconductor pattern 110a."

Such interpretations would directly contradict Hwang's specification. Petitioner is contorting the prior art into something wholly different than what is expressly disclosed. Thus, Petitioner cannot meet its burden of showing that Hwang discloses "at least two adjacent light sensitive image sensor pixels" as required in Claims 1, 8, 17 and 21 of the '764 Patent. Therefore, Petitioner has failed to show anticipation or obviousness, and institution should be denied.

2. Hwang Does Not Disclose "a peripheral sidewall disposed into at least a portion of the pixel and extending at least substantially around the pixel periphery"

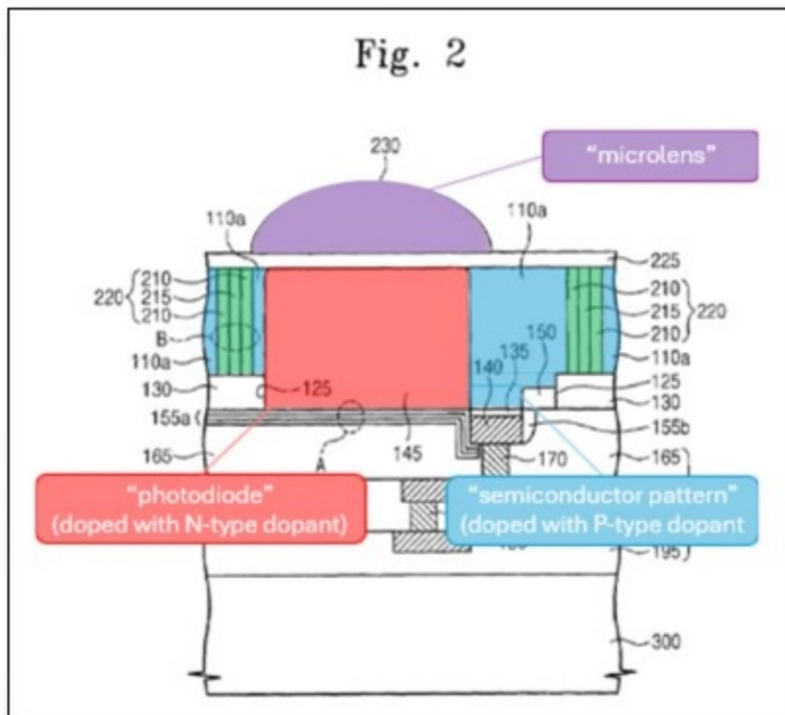
In addition to Petitioner's failure to establish that Hwang teaches or suggests "at least one light sensitive pixel," Petitioner also equates a "sidewall multi-layered reflection layer 220" in Hwang with the claimed "peripheral sidewall disposed into at least a portion of the pixel" (EX1001 ('764 Patent), 17:63-64, 18:31-32, 19:10-11, 20:4-5) in the '764 Patent with little or no explanation. See Petition, 10-11.

This “multi-layered reflection layer 220” does not, however, optically and electrically isolate adjacent pixels, nor does Petitioner attempt to establish that it does so, and therefore there is a critical failure to establish anticipation of this element.

Hwang does not disclose a peripheral sidewall and therefore does not meet this claim element. In Hwang, the pixel semiconductor pattern is designed in a manner that avoids the need to extend around the peripheral sidewall of the pixel. The “multilayered reflection layer 220” shows a physical location that is adjacent to a portion of the “pixel semiconductor patterns 110a.” EX1005 (Hwang), 6:7-23.

The claims of the '764 Patent expressly require that the “peripheral sidewall” is “disposed into at least a portion of the pixel” and extends “substantially around the pixel periphery.” EX1001 ('764 Patent), 18:31-33. This allows not only for the reduction of optical crosstalk (by preventing light that enters one pixel from traveling into a neighboring pixel) and electrical crosstalk (by preventing electrons generated in the pixel from traveling into a neighboring pixel), but also allows for light to be trapped within the pixel to allow for the better detection of light that enters the pixel. See EX1001 ('764 Patent), 6:2-6. This improves pixel performance and image quality, particularly in the context of smaller image sensor pixels which have a smaller region for detecting light. See EX1001 ('764 Patent), 1:20-32.

At best, the Hwang architecture illustrates a “multilayered reflection layer 220” that is positioned near a “pixel semiconductor pattern 110a” that includes a light sensing portion and a large inactive portion, *e.g.*, inactive p-doped portions.



EX1010 (Konno), Fig. 2 (annotated).

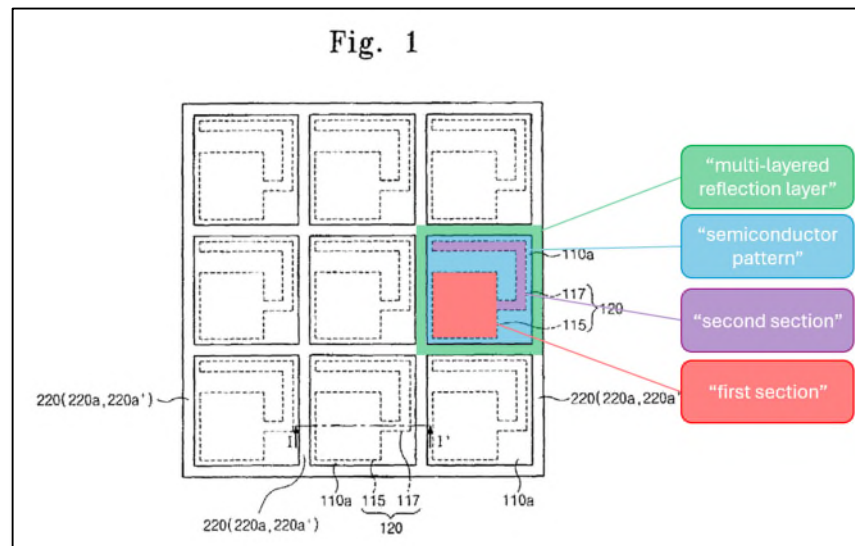
In Hwang, a light sensing portion of the “pixel semiconductor pattern 110a” is positioned proximal to an inactive p-doped portion of the next “pixel semiconductor 110a.” Thus, the “multilayered reflection layer 220” is not providing any meaningful optical isolation between pixels.

Petitioner provides no explanation as to how the “multilayered reflection layer 220” of Hwang is a “peripheral sidewall disposed into at least a portion of the pixel,” (EX1001 (’764 Patent), 17:63-65, 18:31-32, 19:10-12, 20:4-6) except that it

appears to be positioned adjacent to the “pixel semiconductor pattern 110a.” This is not enough to establish that Hwang renders obvious this element of claims 1, 8, 17 or 21.

Further, the alleged peripheral sidewall in Hwang does not meet the claimed “peripheral sidewall” because it does not extend around the pixel periphery as required by the independent claims. Instead, the design of Hwang’s pixel places the sidewall outside of the pixel as evidenced, for example, by the physical spacing between the active region of the pixel and the periphery of the “pixel semiconductor pattern 110a” described in Hwang and shown in Figure 2, above.

This is because the alleged pixel in Hwang provides significant physical separation between the active region and the boundary of the “pixel semiconductor pattern 110a.” See, *e.g.*, EX1005 (Hwang), 6:19-23 (“That is, the sidewall multi-layered reflection layer 220 can be disposed along the boundaries of all of the semiconductor patterns 110a...”). This is illustrated, for example, by Figure 1, which shows that “first section 115” (housing “photodiode 145”) is separated on all sides from multi-layered reflection layer by pixel semiconductor pattern 110a.



EX1010 (Konno), Fig. 1 (annotated). In operation, light is detected by the active region (first section) of the semiconductor pattern (annotated above in red). The regions outside of the first section are portions of the semiconductor pattern that are not detecting light.

Petitioner alleges that Hwang alone discloses or renders obvious the claimed “peripheral sidewall” and does not allege that Hwang in combination with any other reference renders obvious the claimed “peripheral sidewall” recited in the claims. Petition, 11-12, 29, 32, 44. Thus, the Petition fails to show how this claim element is met and Grounds 1 – 4 fail.

3. Petitioner's Obviousness Argument Is Legally Deficient Because It Fails to Make the Required Showing on Motivation

For obviousness, the Petition simply fails to present the proofs necessary to support an obviousness theory. To support anticipation, Petitioner asserts that

Hwang's figures (and the discussion thereof), "teach[] or suggest[]" the Limitations. That is false, as noted herein, but that is Petitioner's position. If Petitioner then wanted to migrate to an obviousness theory, it needed to explain what in the Limitations are not in Hwang, and then set forth why a POSITA would have been motivated to modify or augment Hwang's teachings in a manner that would render the Limitations obvious, with a reasonable expectation of success.

Petitioner also does not make any express obviousness arguments. Instead, Petitioner's entire support for its obviousness theory is its repeated assertions that Hwang "teaches or suggests" the Limitations, and then its arguments pointing to various purported disclosures in Hwang.

Further, as noted above, Petitioner is making a number of arguments that are inconsistent with the express disclosures in Hwang. Thus, Petitioner is implicitly arguing for modifications to the express disclosures in Hwang. However, the Petition is totally silent on why a POSITA would have been motivated to modify Hwang. Likewise, the Petition is totally silent on whether a POSITA would have had a reasonable expectation of success doing so.

"[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention." *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (emphasis in original). A Petitioner bears the burden

of establishing how and *why* a POSITA would have chosen the cited reference and combine or modify it to arrive at the claimed invention with a reasonable expectation of success. *See id.*; *see also Eli Lilly & Co. v. Teva Pharms. Int'l. GmbH*, 8 F.4th 1331, 1334 (Fed. Cir. 2021) (*citing Procter & Gamble Co. v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009)) (“A party seeking to invalidate a patent based on obviousness must demonstrate ‘by clear and convincing evidence that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” (*quoting Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007)) (internal quotation marks omitted).

When an obviousness theory relies on a modification, it must be shown that a POSITA “not only *could have made* but *would have been motivated to make* [that modification].” *Belden*, 805 F.3d at 1073 (emphasis in original). While the law allows for obviousness arguments based on a single reference, “there must be a showing of a suggestion or motivation to modify the teachings of that reference.” *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1356 (Fed. Cir. 2000). Even if Petitioner’s arguments are accepted as true, the Petition is deficient because Petitioner offers no “showing of a suggestion or motivation to modify” the Hwang reference with a reasonable expectation of success. *Id.*

Petitioner's failure to articulate a motivation to modify Hwang is fatal. Without the requisite motivation, the Petition is legally deficient. At best, Petitioner's allegations concerning the Limitations amount to an argument that Hwang *could be modified*. That is not a sufficient basis to support an obviousness theory. "[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention." *Belden Inc.*, 805 F.3d at 1073 (emphasis in original).

B. Ground 2: Hwang (EX1005) In Combination With Konno (EX1010)

Petitioner asserts that the combination of Hwang with Konno renders obvious claims 16-25. See Petition, 2-3, 26-40. As discussed above, Hwang does not anticipate or render obvious each of independent claims 1, 8, 17 and 21, including independent claims 17 and 21 challenged in Ground 2. The remainder of the claims challenged in Ground 2 (16, 18-20, 22-25) depend from one of claims 8, 17 or 21, respectively, and Ground 2 fails for at least the reasons set forth above for Ground 1.

C. Ground 3: Hwang (EX1005) In Combination With Mori (EX1006 / EX1007)³

Petitioner asserts that the combination of Hwang with Mori renders obvious claims 1-5 and 7. *See* Petition, 2-3, 41-51. As discussed above, Hwang does not anticipate or render obvious each of independent claims 1, 8, 17 and 21, including independent claim 1 challenged in Ground 3. The remainder of the claims challenged in Ground 3 (2-5, 7) depend from claim 1 and Ground 3 fails for at least the reasons set forth above for Ground 1.

D. Ground 4: Hwang (EX1005) In Combination With Mori (EX1007) and Konno (EX1010)

Petitioner asserts that the combination of Hwang with Mori and Konno renders obvious claim 6. *See* Petition, 2-3, 51. As discussed above, Hwang does not anticipate or render obvious each of independent claims 1, 8, 17 and 21. Claim 6 depends from claim 1 and Ground 4 fails for at least the reasons set forth above for Ground 1.

³ References to Mori hereinafter cited as EX1007 (which is the certified translation of EX1006).

E. Ground 5: Yamada (EX1011 / EX1012)⁴

Across Grounds 5 through 8, Petitioner argues, but fails to establish, that Yamada discloses the “at least one light sensitive pixel,” which is a limitation in all of independent claims 1, 8, 17, and 21 and which is central to the claims of the ’764 Patent. For all of Grounds 5 to 8, Petitioner relies solely on disclosures from Yamada to meet that limitation. *See* Petition, 2-3, 52-84. Petitioner has not met its burden of showing that Yamada discloses or suggests “at least one light sensitive pixel” because Yamada does not disclose an image sensor. Here again, Petitioner’s argument is undermined by its expert witnesses’ positions.

During claim construction in the ITC investigation, Petitioner did not dispute that a pixel is “the basic light-detecting unit of an image sensor,” and challenged only which structures should be included in a pixel. EX2003 (Fontecchio Claim Construction Decl.), ¶33. The dispute over which structures should be included does not implicate whether a pixel is part of an image sensor, an issue on which both parties (and their experts) appear to agree. *Id.* Similarly, Dr. Lebby’s technology background explains “[a]t the heart of an image sensor lies an array of light-sensitive pixels, each of which is a photodiode capable of detecting light.”

⁴ References to Yamada hereinafter cited as EX1012 (which is the certified translation of EX1011).

EX1003 (Lebby Decl.), ¶37. Both of Samsung's experts (and SiOnyx's expert), agree that a pixel is part of an image sensor.

Yamada does not disclose an image sensor, and Dr. Lebby does not provide any evidence to the contrary. In fact, Dr. Lebby provides only a single conclusory statement ("Yamada is directed to an image sensor") on this key issue, without any support from Yamada's specification. EX1003 (Lebby Decl.), ¶187.

While Yamada does not provide any disclosure of an image sensor, it provides ample disclosure that it is a fiber optic device used for high-speed optical communications. For example, Yamada discloses an array of PIN photodiodes, a structure not typically associated with image sensing and commonly found in fiber-optic devices. EX1012 (Yamada), [0023], [0054]. Furthermore, Yamada's PIN photodiodes are made from $\text{Si}_x\text{Ge}_{1-x}$ or In_xGaAs , materials selected for their absorption of infrared light. EX1012 (Yamada), [0023]. These materials are consistent with fiber-optic communications devices, which typically operate on infrared light or near infrared light. *See, e.g.*, EX2004, 2 (FOA Reference Guide) ("the normal wavelengths are 850, 1300, and 1550nm"). In contrast, image sensors, which operate on visible-spectrum light, use materials like silicon. *See, e.g.*, EX1001 ('764 Patent), 1:12-13 ("Image sensors are typically formed on various forms of semiconductor materials such as, for example, silicon.")

With no evidence to support his conclusion that “Yamada is directed to an image sensor” and with ample evidence to the contrary, Dr. Lebby has not substantiated his conclusion that Yamada discloses or suggests “at least one light sensitive pixel” (see EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2). Petitioner cannot meet its burden for institution based on a single, conclusory sentence in an expert declaration that directly contradicts the explicit disclosure of the reference asserted.

Grounds 5-8 address each of the independent claims, claims 1, 8, 17 and 21. For each of Grounds 5-8, the Petition relies only on Yamada to address the claim limitation of “at least one light sensitive pixel,” which is present in all the independent claims. EX1001 ('764 Patent), 17:61, 18:29, 19:8, 20:2. Thus, Grounds 5-8 fail because of Petitioner's failure to show that Yamada, alone or in combinations with Schubert, Mori, and Konno (as discussed below), renders obvious “at least one light sensitive pixel.”

F. Ground 6: Yamada (EX1012) In Combination With Schubert (EX1013)

Petitioner asserts that the combination of Yamada with Schubert renders obvious claim 8-11 and 13. See Petition, 3, 65-70. As discussed above, Yamada does not render obvious each of independent claims 1, 8, 17 and 21, including independent claim 8 challenged in Ground 6. The remainder of the claims

challenged in Ground 6 (9-11, 13) ultimately depend from claim 8 and Ground 6 fails for at least the reasons set forth above for Ground 5.

G. Ground 7: Yamada (EX1012) In Combination With Schubert (EX1013) and Mori (EX1007)

Petitioner asserts that the combination of Yamada with Schubert and Mori renders obvious claims 1-7. *See* Petition, 3, 71-76. As discussed above, Yamada does not render obvious each of independent claims 1, 8, 17 and 21, including independent claim 1 challenged in Ground 7. The remainder of the claims challenged in Ground 7 (2-7) depend from claim 1 and Ground 7 fails for at least the reasons set forth above for Ground 5.

H. Ground 8: Yamada (EX1012) In Combination With Konno (EX1010)

Petitioner asserts that the combination of Yamada with Konno renders obvious claims 17-25. *See* Petition, 3, 77-84. As discussed above, Yamada does not render obvious each of independent claims 1, 8, 17 and 21, including independent claims 17 and 21 challenged in Ground 8. The remainder of the claims challenged in Ground 8 (18-20, 22-25) depend from claims 17 and 21, respectively, and Ground 8 fails for at least the reasons set forth above for Ground 5.

V. CONCLUSION

For the reasons set forth above, Petitioner has failed to demonstrate a reasonable likelihood that it would prevail with respect to any of the Challenged Claims. Thus, *inter partes* review of the '764 Patent should be denied.

Date: April 21, 2025

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Patent Owner's Preliminary Response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 4,663 words, according to the word-processing system used to prepare this preliminary response, excluding the parts of this preliminary response that are exempted by 37 C.F.R. § 42.24(c) (including the table of contents, a table of authorities, an exhibits list, a listing of facts, a certificate of service or this certificate of word count, or appendix of exhibits).

Date: April 21, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), this is to certify that on this 17th day of April, 2025, I caused to be served a true and correct copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE (with EX2002-2004)** by e-mail (as agreed in the Service Information section of the Petition):

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