

Filed on behalf of:

Patent Owner

By: Alison L. McCarthy (Lead Counsel)

Alison.McCarthy@Troutman.com

Dustin N. Ferzacca (Back-up Counsel)

Dustin.Ferzacca@Troutman.com

Andrew P. Zappia (Back-up Counsel)

Andrew.Zappia@Troutman.com

Paper No. _____

Date: April 17, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

SIONYX, LLC,
Patent Owner.

Case IPR2025-00163
Patent 10,224,359 B2

PATENT OWNER'S PRELIMINARY RESPONSE

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

TABLE OF CONTENTS

	Page
TABLE OF AUTHORITIES	iii
LIST OF PATENT OWNER’S EXHIBITS	iv
CLAIM LISTING FOR U.S. PATENT NO. 11,224,359	v
I. INTRODUCTION	1
II. SUMMARY OF ARGUMENTS	3
III. PETITIONER’S GROUNDS	5
IV. INSTITUTION SHOULD BE DENIED IN LIGHT OF PETITIONER’S FAILURE TO ESTABLISH ANTICIPATION OR OBVIOUSNESS BASED ON HWANG	6
A. Ground 1: Hwang (EX1006)	6
1. Hwang Does Not Disclose “at least two adjacent light sensitive image sensor pixels”	6
2. Hwang Does Not Disclose “a peripheral isolation element [at least partially] separating said [at least] two adjacent light sensitive pixels”	11
3. Petitioner’s Obviousness Argument Is Legally Deficient Because It Fails To Make The Required Showing On Motivation	13
B. Ground 2: Hwang (EX1006) In Combination With Haddad188 (EX1007)	16
C. Ground 3: Hwang (EX1006) In Combination With Shinohara (EX1008)	16
D. Ground 4: Hwang (EX1006) In Combination With Roy (EX1009)	16

IPR2025-00163 (Patent 10,224,359)
Patent Owner’s Preliminary Response

V. CONCLUSION.....	17
CERTIFICATE OF COMPLIANCE.....	18
CERTIFICATE OF SERVICE	19

TABLE OF AUTHORITIES

	Page
CASES	
<i>Belden Inc. v. Berk-Tek LLC</i> , 805 F.3d 1064 (Fed. Cir. 2015)	14, 15, 16
<i>Eli Lilly & Co. v. Teva Pharms. Int’l. GmbH</i> , 8 F.4th 1331 (Fed. Cir. 2021)	14
<i>Pfizer, Inc. v. Apotex, Inc.</i> , 480 F.3d 1348 (Fed. Cir. 2007)	15
<i>Procter & Gamble Co. v. Teva Pharms. USA, Inc.</i> , 566 F.3d 989 (Fed. Cir. 2009)	14
<i>SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.</i> , 225 F.3d 1349 (Fed. Cir. 2000)	15
CODES, REGULATIONS AND OTHER AUTHORITIES	
35 U.S.C. § 102	3, 5
35 U.S.C. § 103	3, 5, 13
35 U.S.C. § 313	1
35 U.S.C. § 314(a)	1
37 C.F.R. § 42.107(a)	1
37 C.F.R. § 42.108(c)	1
Memorandum Regarding Interim Processes for PTAB Workload Management (PTAB Mar. 26, 2025)	1, 2

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 17, 2025 with Patent Owner's Preliminary Response
2002	Order No. 36: Construing Certain Claim terms in <i>Certain Sensor with Pixels ad Products Containing the Same</i> , Inv. No. 337-TA-1403 (ITC Jan. 15, 2025) ("ITC Markman Order")
2003	Witness Statement of Dr. Dean Neikirk dated March 19, 2025 in <i>In the Matter of CERTAIN SENSORS WITH PIXELS AND PRODUCTS CONTAINING THE SAME</i> , Inv. No. 337-TA-1403 (ITC) (REDACTED Version) ("Neikirk Witness Statement")

CLAIM LISTING FOR U.S. PATENT NO. 11,224,359

1. [1Preamble] An imager device, comprising:
 - [1a] at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;
 - [1b] a peripheral isolation element at least partially separating said two adjacent light sensitive pixels;
 - [1c] each of said pixels having at least one doped region disposed on at least one of the light incident surface and the backside surface,
 - [1d] wherein the peripheral isolation element comprises at least two materials having different indices of refraction,
 - [1e] wherein said peripheral isolation element comprises a first, a second and a third layer,
 - [1f] wherein said third layer is disposed between said first and second layers, and
 - [1g] wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.
2. The device of claim 1, wherein the index of refraction of at least one of said first and second layer is at least 0.2 lower relative to the refractive index of the third layer.

3. The device of claim 1, wherein at least one of said at least two materials comprises silicon dioxide.
4. The device of claim 1, wherein at least one of said first and second layers comprises silicon dioxide.
5. The device of claim 1, wherein the isolation element extends substantially from the light incident surface to the backside surface of at least one of said two adjacent light sensitive pixels.
6. The device of claim 1, wherein at least one of the first and second layer comprises Al_2O_3 .
7. The device of claim 1, wherein said peripheral isolation element comprises an oxide.
8. The device of claim 1, wherein said peripheral isolation element provides a passivating negative charge.
9. The device of claim 1, wherein said peripheral isolation element exhibits a surface recombination velocity as low as 10 cm/s.
10. The device of claim 1, wherein the peripheral isolation element comprises at least one material having an index of refraction of less than about 2.1.
11. The device of claim 1, wherein the peripheral isolation element comprises any of aluminum oxide and hafnium oxide.

12. The device of claim 1, wherein at least one of said two adjacent light sensitive pixels comprises a textured region.

13. The device of claim 12, wherein said textured region is coupled to the light incident surface.

14. The device of claim 13, wherein said light incident surface comprises said textured region.

15. The device of claim 13, wherein said textured region comprises a textured film layer.

16. The device of claim 15, wherein said textured film layer comprises any of silicon dioxide, silicon nitride, amorphous silicon, polysilicon, a metal and combinations thereof.

17. The device of claim 12, wherein said backside surface comprises said textured region.

18. **[18Preamble]** An imager device, comprising:

[18a] at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;

[18b] a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween,

[18c] said isolation element comprising at least two materials having different indices of refraction,

[18d] at least one doped region disposed on at least one of the light incident surface and the backside surface,

[18e] wherein said peripheral isolation element comprises a first, a second and a third layer,

[18f] wherein said third layer is disposed between said first and second layers, and

[18g] wherein each of said first and second layers exhibits an index of refraction less than an index of refraction of said third layer.

19. The device of claim 18, wherein at least one of said light incident surface and said backside surface of at least one of said two adjacent light sensitive pixels comprises a textured region.

20. The device of claim 19, wherein said textured region is a textured film layer.

21. The device of claim 20, wherein said textured film layer comprises any of silicon dioxide, silicon nitride, amorphous silicon, polysilicon, a metal and combinations thereof.

22. The device of claim 19, wherein said textured region reflects at least a portion of light internally incident thereon into the at least one pixel.

23. The device of claim 18, wherein the peripheral isolation element extends from the light incident surface to the backside surface of at least one of said two adjacent light sensitive pixels.

24. The device of claim 18, wherein said at least two materials comprises silicon dioxide and aluminum oxide.

25. The device of claim 19, wherein said at least two pixels are formed monolithically in a common semiconductor substrate.

26. The device of claim 19, wherein the textured region is formed by laser radiation.

27. The device of claim 12, wherein the textured region is formed by one of plasma etching, reactive ion etching, porous silicon etching, lasing, chemical etching, nanoimprinting, material deposition, selective epitaxial growth, and combinations thereof.

28. The device of claim 12, wherein the textured region is formed by laser radiation.

29. The device of claim 12, wherein said textured region is coupled to the backside surface.

30. The device of claim 1, wherein said peripheral isolation element comprises tantalum oxide.

31. The device of claim 30, wherein said tantalum oxide comprises tantalum aluminum oxynitride.

32. The device of claim 1, wherein said peripheral isolation element comprises lanthanum oxide.

33. The device of claim 32, wherein said lanthanum oxide comprises lanthanum aluminum oxide.

34. The device of claim 18, wherein said peripheral isolation element comprises tantalum oxide.

35. The device of claim 34, wherein said tantalum oxide comprises tantalum aluminum oxynitride.

36. The device of claim 18, wherein said peripheral isolation element comprises lanthanum oxide.

37. The device of claim 36, wherein said lanthanum oxide comprises lanthanum aluminum oxide.

38. The device of claim 1, wherein each of said at least two adjacent light sensitive image sensor pixels comprises a semiconductor portion providing said light incident surface and said backside surface, wherein said peripheral isolation element isolates

the semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

39. The device of claim 38, wherein said peripheral isolation element optically isolates said semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

40. The device of claim 38, wherein said peripheral isolation element electrically isolates said semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

41. The device of claim 38, wherein an index of refraction of the semiconductor portion of each of said at least two adjacent image sensor pixels is different from indices of refraction of said layers of the peripheral isolation element such that light incident from each of said semiconductor portions on said peripheral isolation element is reflected, thereby providing optical isolation between the pixels.

42. The device of claim 1, wherein said at least two adjacent light sensitive image sensor pixels are formed monolithically on a common semiconductor substrate and are isolated from one another by said peripheral isolation element.

43. The device of claim 1, wherein said peripheral isolation element is a trench isolation element.

44. The device of claim 1, wherein said peripheral isolation element has a width in a range from about 100 nm to about 50 microns.

45. The device of claim 18, wherein each of said at least two adjacent light sensitive image sensor pixels comprises a semiconductor portion providing said light incident surface and said backside surface, wherein said peripheral isolation element isolates the semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

46. The device of claim 45, wherein said peripheral isolation element optically isolates said semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

47. The device of claim 46, wherein said peripheral isolation element electrically isolates said semiconductor portions of said at least two adjacent light sensitive image sensor pixels.

48. The device of claim 47, wherein an index of refraction of the semiconductor portion of each of said at least two adjacent image sensor pixels is different from indices of refraction of said layers of the peripheral isolation element such that light incident from each of said semiconductor portions on said peripheral isolation element is reflected, thereby providing optical isolation between the pixels.

49. The device of claim 18, wherein said at least two adjacent light sensitive image sensor pixels are formed monolithically on a common semiconductor substrate and are isolated from one another by said peripheral isolation element.

50. The device of claim 18, wherein said peripheral isolation element is a trench isolation element.

51. The device of claim 18, wherein said peripheral isolation element has a width in a range from about 100 nm to about 50 microns.

52. The imager device of claim 38, wherein at least one of the first layer and the second layer of said peripheral isolation element and said semiconductor portion of each of said at least two adjacent pixels comprise different materials.

53. The imager device of claim 1, wherein the first layer and the second layer of said peripheral isolation element comprise different materials.

54. The imager device of claim 1, wherein the peripheral isolation element comprises at least three materials.

55. The imager device of claim 1, wherein the peripheral isolation element comprises more than three layers.

56. The imager device of claim 1, wherein the peripheral isolation element comprises a light trapping material filling a trench.

57. The imager device of claim 56, wherein the trench is one of a shallow trench and a deep trench.

58. The imager device of claim 45, wherein at least one of the first layer and the second layer of the peripheral isolation element and said semiconductor portion of each of said at least two adjacent pixels comprise different materials.

59. The imager device of claim 18, wherein the first layer and the second layer of said peripheral isolation element comprise different materials.

60. The imager device of claim 18, wherein the peripheral isolation element comprises at least three materials.

61. The imager device of claim 18, wherein the peripheral isolation element comprises more than three layers.

62. The imager device of claim 18, wherein the peripheral isolation element comprises a light trapping material filling a trench.

63. The imager device of claim 62, wherein the trench is one of a shallow trench and a deep trench.

64. The imager device of claim 1, wherein said peripheral isolation element comprises a trench isolation element formed by filling a trench with said first, said second, and said third layers.

65. The imager device of claim 64, wherein said trench isolation element has a depth in a range of about 100 nm to about 50 microns.

66. The imager device of claim 65, wherein said trench isolation element has a width in a range of about 100 nm to about 10 microns.

67. The imager device of claim 1, wherein said peripheral isolation element is configured to reflect at least a portion of light incident thereon from any of said two adjacent light sensitive pixels back to that pixel.

68. The imager device of claim 67, wherein the peripheral isolation element is further configured to optically isolate said two adjacent light sensitive pixels.

69. The imager device of claim 68, wherein the peripheral isolation element is further configured to electrically isolate said two adjacent light sensitive pixels.

70. The imager device of claim 18, wherein said peripheral isolation element comprises a trench isolation element formed by filling a trench with said first, said second, and said third layers.

71. The imager device of claim 70, wherein said trench isolation element has a depth in a range of about 100 nm to about 50 microns.

72. The imager device of claim 71, wherein said trench isolation element has a width in a range of about 100 nm to about 10 microns.

73. The imager device of claim 18, wherein said peripheral isolation element is configured to reflect at least a portion of light incident thereon from any of said two adjacent light sensitive pixels back to that pixel.

74. The imager device of claim 73, wherein the peripheral isolation element is further configured to optically isolate said two adjacent light sensitive pixels.

75. The imager device of claim 74, wherein the peripheral isolation element is further configured to electrically isolate said two adjacent light sensitive pixels.

76. The imager device of claim 1, wherein the peripheral isolation element comprises a textured region.

77. The imager device of claim 1, wherein the peripheral isolation element further comprises a first textured region between the first layer and one of said adjacent pixels and a second textured region between the second layer and the other one of said adjacent pixels.

78. The imager device of claim 18, wherein the peripheral isolation element comprises a textured region.

79. The imager device of claim 18, wherein the peripheral isolation element further comprises a first textured region between the first layer and one of said adjacent pixels and a second textured region between the second layer and the other one of said adjacent pixels.

80. The imager device of claim 1, wherein the peripheral isolation element comprises five layers.

81. The imager device of claim 80, wherein the five layers include the first layer, the second layer, the third layer, a fourth layer disposed between the first layer and one of said adjacent pixels and a fifth layer disposed between the second layer and the other one of said adjacent pixels.

82. The imager device of claim 18, wherein the peripheral isolation element comprises five layers.

83. The imager device of claim 82, wherein the five layers include the first layer, the second layer, the third layer, a fourth layer disposed between the first layer and one of said adjacent pixels and a fifth layer disposed between the second layer and the other one of said adjacent pixels.

EX1001 ('359 Patent), 18:27-22:55.

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 Petition for *Inter Partes* Review (Paper 4) (“Petition”) of claims 1-30, 32, 34, 36, 38-83 (the “Challenged Claims”) of U.S. Patent No. 10,224,359 (EX1001) (“the ’359 Patent”) filed by Petitioner Samsung Electronics Co., Ltd. on November 29, 2024, with a filing date accorded of November 29, 2024 per the notice mailed on January 17, 2025 (Paper 9). 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 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 (PTAB Mar. 26, 2025).

Even if discretionary denial were not warranted, the Petition fails on the merits. Claims 1 and 18 are the only independent claims in the '359 Patent. As discussed below, Petitioner has not met its burden to show a reasonable likelihood that the Hwang (EX1006) reference invalidates either of claims 1 or 18 as asserted in Ground 1. See Petition, 3, 8-17. Furthermore, because none of the remaining Grounds addresses the deficiencies of Hwang with respect to the independent claims, institution should be denied.

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 period expired before the issuance of the Memorandum, a Patent Owner may file its paper seeking discretionary denial within one (1) month following the issuance of the Memorandum. In this proceeding, the two (2) month period expired on March 17, 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 Hwang² alone or in combination with Haddad¹⁸⁸, Shinohara, or Roy. As to independent claims 1 and 18, Petitioner relies on Hwang alone, under a theory described as “anticipated, or at a minimum obvious.” Petition, 3. However, Petitioner has not presented arguments sufficient to support invalidity of those claims or the other Challenged Claims (all of which depend from independent claims 1 and 18), under 35 U.S.C. §102 (anticipation) or §103 (obviousness).

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 (i) “at least two adjacent light sensitive image sensor pixels”; or (ii) “a peripheral isolation element [at least partially] separating said [at least] two adjacent light sensitive pixels,” as required by the independent claims. EX1001 ('359 Patent), 18:28, 31-32 and 19:18, 21-22. Petitioner's failure to show these elements in Hwang removes Hwang as a viable anticipatory reference. Petitioner's assertions not only find no intrinsic support in Hwang, but in fact they

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

contradict express teachings in Hwang. As a result, the Petition fails to establish anticipation of the independent claims.

To the extent Petitioner's backup position is obviousness, that theory is inconsistent with its anticipation argument and the Petition wholly fails to present the proofs necessary to support an obviousness theory. To support anticipation, Petitioner asserts that Hwang's figures (and its discussion thereof), "teach[] or suggest[]" all the limitations of claims 1 and 18. 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 limitations in claims 1 and 18 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 claims 1 and 18 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 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.

Therefore, institution should be denied.

III. PETITIONER'S GROUNDS

Petitioner proffers four (4) Grounds for the Challenged Claims (claims 1-30, 32, 34, 36, 38-83):

Ground	[Petition] Challenged Claims	Basis for Rejection
1	1-5, 7, 10, 18, 23, 25, 38-43, 45-50, 52-64, 67-70, 73-75, 80-83	§102 and/or §103: Hwang (EX1006)
2	12-17, 19-22, 26-29, 76-79	§103: Hwang (EX1006) and Haddad188 (EX1007)
3	6, 8, 9, 11, 24, 30, 32, 34, 36	§103: Hwang (EX1006) and Shinohara (EX1008)
4	44, 51, 65-66, 71-72	§103: Hwang (EX1006) and Roy (EX1009)

See Petition, 3-4.

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. First, Petitioner's anticipation arguments based on Hwang fail. Second, Petitioner has not shown why a POSITA *would have been* motivated to modify Hwang to have "a peripheral isolation element [at least partially] separating said [at least] two adjacent light sensitive pixels," which are limitations in all the Challenged Claims.

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

A. Ground 1: Hwang (EX1006)

Petitioner posits that Hwang either anticipates or renders obvious the limitations of claims 1-5, 7, 10, 18, 23, 25, 38-43, 45-50, 52-64, 67-70, 73-75, and 80-83. Petition, 8. Petitioner, however, fails to meet its burden of showing that Hwang discloses the “light sensitive image sensor pixels,” which is central to the claims of the '359 Patent. EX1001 ('359 Patent), 18:28 and 19:18. Nor does Petitioner establish “a peripheral isolation element [at least partially] separating said [at least] two adjacent light sensitive pixels”, as required in both independent claims 1 and 18 of the '359 Patent. EX1001 ('359 Patent), 18:31-32 and 19:21-22.

1. Hwang Does Not Disclose “at least two adjacent light sensitive image sensor pixels”

Petitioner presents insufficient evidence that Hwang discloses “at least two adjacent light sensitive image sensor pixels”. EX1001 ('359 Patent), 18:28 and 19:18. First, Petitioner's invalidity theory relies on Hwang's “pixel semiconductor pattern 110a” as “teach[ing] or suggest[ing]” the limitation of “at least two adjacent light sensitive image sensor pixels.” Petition, 9-12. However, Petitioner provides insufficient evidence that the “pixel semiconductor pattern 110a” in Hwang is the same as the claimed “at least two adjacent light sensitive image sensor pixels.”

Petitioner has consistently admitted that a pixel converts light into an electrical signal. EX2002 (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, 9, fn. 2. 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.), ¶¶59, 60, fn. 3. These arguments by Petitioner and Dr. Lebby, which contradict the actual teachings of Hwang, cannot support Petitioner's positions.

Petitioner lacks sufficient evidence to show that Hwang's "pixel semiconductor pattern 110a" is a pixel. Hwang's inventors clearly knew the term "pixel," as the specification uses the word both as part of the longer phrase "pixel semiconductor pattern" and in the context of generally describing image sensors. *See, e.g.*, EX1006 (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 the 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 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 (“ALJ”) noted that “[b]oth parties' experts agree that the ‘pixel’ converts light into electrical signals.” EX2002 (ITC Markman Order), 22 (internal quotation marks and 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).

EX2003 (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.” *See, e.g.*, EX1006 (Hwang), 1:26-29, 6:4-6.

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.” EX1006 (Hwang), 6:4-6. The depletion region is the portion of a photodiode where absorbed light generates photocurrent. *See, e.g.*, EX1006 (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 micro lens positioned over “photodiode 145” such that incident light will be focused onto the depletion region. *See, e.g.*, EX1006 (Hwang), Fig. 2; *see also, e.g.*, EX1006 (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 micro lens confirms that Hwang’s “pixel semiconductor pattern 110a” is not a pixel. If the entire “pixel semiconductor pattern 110a” could convert light into an electrical

signal, the micro lens 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,” POSITAs would understand that photodiode, 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.), ¶59 at n.3. 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; 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

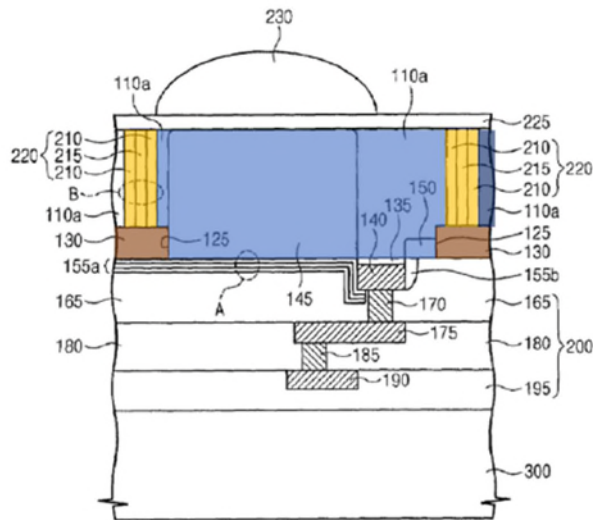
expressly disclosed. Thus, Petitioner cannot meet its burden of showing that Hwang discloses “at least two adjacent light sensitive image sensor pixels” as required in Claims 1 and 18 of the '359 Patent. Thus, Petitioner has failed to show anticipation or obviousness, and institution should be denied.

2. Hwang Does Not Disclose “a peripheral isolation element [at least partially] separating said [at least] two adjacent light sensitive pixels”

In addition to Petitioner's failure to establish that Hwang teaches or suggests “adjacent light sensitive image sensor pixels,” Petitioner also equates a “sidewall multi-layered reflection layer 220” in Hwang with the claimed “peripheral isolation element” in the '359 Patent with little or no explanation. Petition, 12-13. 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, a critical failure to establish anticipation of this element.

Petitioner relies on Figure 2 in Hwang to establish this element. Figure 2, below, includes element 220:

Fig. 2



Petition, 13 (EX1006 (Hwang), Fig 2. annotated by Petitioner). The “multi-layered reflection layer 220” shows a physical location that is adjacent to a portion of the “pixel semiconductor pattern 110a.” The Petition does not address, as is required, how this “multi-layered reflection layer 220” is a “peripheral isolation element” that “optically and/or electrically isolate[s] neighboring pixels from one another in addition to trapping light within the pixel,” and to “reduce cross-talk between pixel elements.” EX1001 (’359 Patent), 6:20-22, 6:26-29. In other words, the Petition does not address how Hwang provides “[at least partially] separating said [at least] two adjacent light sensitive pixels” with a “peripheral isolation element,” nor can it, because the architecture of Hwang does not teach this feature.

At best, the Hwang architecture illustrates is a “multi-layered 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. 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 pattern 110a.” Thus, the “multi-layered reflection layer 220” is not providing any meaningful optical isolation between two adjacent light sensitive pixels.

Petitioner provides no explanation as to how the “multi-layered reflection layer 220” is a “peripheral isolation element,” except that it appears to be positioned adjacent to the “pixel semiconductor pattern 110a.” This is not enough to establish that Hwang anticipates or renders obvious this limitation of independent claims 1 and 18.

3. Petitioner's Obviousness Argument Is Legally Deficient Because It Fails To Make The Required Showing On Motivation

If Petitioner is asserting that Hwang is an invalidating reference under 35 U.S.C. §103 for Ground 1, that assertion fails for the same reasons as noted above, and also because Petitioner does not present a position supporting the required elements for an obviousness finding.

Petitioner also does not make any express obviousness arguments. Instead, Petitioner's entire support for any obviousness theory is its repeated assertions that Hwang "teaches or suggests" each limitation of claims 1 and 18, 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 claims 1 and 18 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 (EX1006) In Combination With Haddad188 (EX1007)

Petitioner asserts that the combination of Hwang with Haddad188 renders obvious claims 12-17, 19-22, 26-29, and 76-79. *See* Petition, 3, 47-62. These claims depend from one of claims 1 or 18, and Ground 2 fails for at least the reasons that Ground 1 fails, as described above.

C. Ground 3: Hwang (EX1006) In Combination With Shinohara (EX1008)

Petitioner asserts that the combination of Hwang with Shinohara renders obvious claims 6, 8, 9, 11, 24, 30, 32, 34, and 36. *See* Petition, 3, 62-71. These claims depend from one of claims 1 or 18, and Ground 3 fails for at least the reasons that Ground 1 fails, as described above.

D. Ground 4: Hwang (EX1006) In Combination With Roy (EX1009)

Petitioner asserts that the combination of Hwang with Roy renders obvious claims 44, 51, 65-66, and 71-72. *See* Petition, 3, 71-77. These claims depend from one of claims 1 or 18, and Ground 4 fails for at least the reasons that Ground 1 fails, as described above.

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 '359 Patent should be denied.

Respectfully submitted,

Date: April 17, 2025

/Alison L. McCarthy/

Alison L. McCarthy (Lead Counsel)
Registration No. 51,998

Counsel for Patent Owner

CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this preliminary response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 3,247 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 17, 2025

/Alison L. McCarthy/
Alison L. McCarthy (Lead Counsel)
Registration No. 51,998

Counsel for Patent Owner

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 EX2002-2003)** by e-mail (as agreed in the Service Information section of the Petition):

David A. Garr (Lead Counsel)
Reg. No. 74,932
COVINGTON & BURLING LLP
One CityCenter
850 Tenth Street, NW
Washington, DC 20001
Tel: (202) 662-5250
Fax: (202) 778-5250
Service email: dgarr@cov.com
Samsung-SiOnyx-IPR-Cov@cov.com

Counsel for Petitioner

Scott C. Weidenfeller (Back-up Counsel)
Reg. No. 54,531
COVINGTON & BURLING LLP
One CityCenter
850 Tenth Street, NW
Washington, DC 20001
Tel: (202) 662-5923
Fax: (202) 778-5923
Service email: sweidenfeller@cov.com

Counsel for Petitioner

Alice J. Ahn (Back-up Counsel)
Reg. No. 79,829
COVINGTON & BURLING LLP
Salesforce Tower
415 Mission Street, Ste. 5400
San Francisco, CA 94105-2533
Tel: (415) 591-7091
Fax: (415) 955-6591
Service email: aahn@cov.com

Counsel for Petitioner

/Alison L. McCarthy/
Alison L. McCarthy (Lead Counsel)
Registration No. 51,998

Counsel for Patent Owner