UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of **CERTAIN SENSORS WITH PIXELS AND PRODUCTS CONTAINING THE SAME**	**Inv. No. 337-TA-1403**

ORDER NO. 36: CONSTRUING CERTAIN CLAIM TERMS

(January 15, 2025)

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I. INTRODUCTION

This Investigation was instituted by the Commission on June 5, 2024 to determine whether the importation into the United States, the sale for importation, or the sale within the United States after importation of certain sensors with pixels and products containing the same violates section 337 of the Tariff Act of 1930, as amended, due to infringement of U.S. Patent Nos. 9,064,764 ("the '764 patent"), 9,905,599 ("the '599 patent"), 10,224,359 ("the '359 patent"), 11,069,737 ("the '737 patent") and 11,721,714 ("the "714 patent") (collectively, "the Asserted Patents"). *See* 89 Fed. Reg. 48,191 (June 5, 2024). SiOnyx, LLC ("SiOnyx") is the complainant. The Notice of Institution named the following entities as respondents: Samsung Electronics Co., Ltd; Samsung Electronics America, Inc.; and Samsung Semiconductor, Inc. (collectively, "Samsung"). *Id*.

The parties have proposed terms from each of the Asserted Patents for construction. A *Markman* hearing was held on October 29, 2024. After the hearing and pursuant to the Ground Rules, the parties submitted an updated Joint Claim Construction Chart.[1]

On December 10, 2024, I granted SiOnyx's motion to terminate claims 1-7, 12, 13, 19, 22, and 24 of the '764 patent, claims 2, 3, 10, 12-17, 20-21, 25, 27, 29, 34, and 35 of the '599 patent, claims 2-4, 9-10, 22, 25, 27, 30, 34, 38-40, 42-43, 45-47, 49-53, 56-59, 62-63, 65-67, 71-73, 76, 81, and 83 of the '359 patent, claims 1, 8, 9, 11, 14, 15, 17, 23, 25, 27, 31, 32, 34, 37, 40, 42, 46, 47, and 53 of the '737 patent, and claims 7, 8, and 14-16 of the '714 patent. Order No. 31, *not reviewed*, Comm'n Notice (Dec. 23, 2024).

[1] For convenience, the briefs and chart submitted by the parties are referred to hereafter as:

CMIB	SiOnyx's Initial *Markman* Brief
CMRB	SiOnyx's Reply *Markman* Brief
RMIB	Samsung's Initial *Markman* Brief
RMRB	Samsung's Reply *Markman* Brief
JC	Updated Joint Proposed Claim Construction Chart

II. IN GENERAL

The claim terms construed in this Order are done so for the purposes of this section 337 Investigation. Those terms not in dispute need not be construed. *See Vanderlande Indus. Nederland BV v. Int'l Trade Comm'n*, 366 F.3d 1311, 1323 (Fed. Cir. 2004) (noting that the administrative law judge need only construe disputed claim terms).

III. RELEVANT LAW

"An infringement analysis entails two steps. The first step is determining the meaning and scope of the patent claims asserted to be infringed. The second step is comparing the properly construed claims to the device accused of infringing." *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (*en banc*) (internal citations omitted), *aff'd*, 517 U.S. 370 (1996). Claim construction is a "matter of law exclusively for the court." *Id.* at 970-71. "The construction of claims is simply a way of elaborating the normally terse claim language in order to understand and explain, but not to change, the scope of the claims." *Embrex, Inc. v. Serv. Eng'g Corp.*, 216 F.3d 1343, 1347 (Fed. Cir. 2000).

Claim construction focuses on the intrinsic evidence, which consists of the claims themselves, the specification, and the prosecution history. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (*en banc*); *see also Markman*, 52 F.3d at 979. As the Federal Circuit in *Phillips* explained, courts must analyze each of these components to determine the "ordinary and customary meaning of a claim term" as understood by a person of ordinary skill in the art at the time of the invention. 415 F.3d at 1313. "Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language." *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Grp., Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001).

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips*, 415 F.3d at 1312 (quoting

Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004)). "Quite apart from the written description and the prosecution history, the claims themselves provide substantial guidance as to the meaning of particular claims terms." *Id*. at 1314; *see also Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001) ("In construing claims, the analytical focus must begin and remain centered on the language of the claims themselves, for it is that language that the patentee chose to use to 'particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention.'"). The context in which a term is used in an asserted claim can be "highly instructive." *Phillips*, 415 F.3d at 1314. Additionally, other claims in the same patent, asserted or unasserted, may also provide guidance as to the meaning of a claim term. *Id.*

The specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Id.* at 1315 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). "[T]he specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess. In such cases, the inventor's lexicography governs." *Id.* at 1316. "In other cases, the specification may reveal an intentional disclaimer, or disavowal, of claim scope by the inventor." *Id.* As a general rule, however, the particular examples or embodiments discussed in the specification are not to be read into the claims as limitations. *Id.* at 1323. In the end, "[t]he construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be . . . the correct construction." *Id.* at 1316 (quoting *Renishaw PLC v. Marposs Societa´ per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998)).

In addition to the claims and the specification, the prosecution history should be examined, if in evidence. *Id.* at 1317; *see also Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed.

Cir. 2004). The prosecution history can "often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be." *Phillips*, 415 F.3d at 1317; *see also Chimie v. PPG Indus. Inc.*, 402 F.3d 1371, 1384 (Fed. Cir. 2005) ("The purpose of consulting the prosecution history in construing a claim is to 'exclude any interpretation that was disclaimed during prosecution.'").

When the intrinsic evidence does not establish the meaning of a claim, then extrinsic evidence (*i.e.*, all evidence external to the patent and the prosecution history, including dictionaries, inventor testimony, expert testimony, and learned treatises) may be considered. *Phillips*, 415 F.3d at 1317. Extrinsic evidence is generally viewed as less reliable than the patent itself and its prosecution history in determining how to define claim terms. *Id.* at 1317. "The court may receive extrinsic evidence to educate itself about the invention and the relevant technology, but the court may not use extrinsic evidence to arrive at a claim construction that is clearly at odds with the construction mandated by the intrinsic evidence." *Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 977 (Fed. Cir. 1999).

If, after a review of the intrinsic and extrinsic evidence, a claim term remains ambiguous, the claim should be construed so as to maintain its validity. *Phillips*, 415 F.3d at 1327. Claims, however, cannot be judicially rewritten in order to fulfill the axiom of preserving their validity. *See Rhine v. Casio, Inc.*, 183 F.3d 1342, 1345 (Fed. Cir. 1999). Thus, "if the only claim construction that is consistent with the claim's language and the written description renders the claim invalid, then the axiom does not apply and the claim is simply invalid." *Id.*

A claim must also be definite. Pursuant to 35 U.S.C. § 112, second paragraph: "The specification shall conclude with one or more claims particularly pointing out and distinctly

claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. In Nautilus, *Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120 (2014), the Supreme Court held that § 112, ¶ 2 requires "that a patent's claims, viewed in light of the specification and prosecution history inform those skilled in the art about the scope of the invention with reasonable certainty." (*Id.* at 2129.) A claim is required to "provide objective boundaries for those of skill in the art," and a claim term is indefinite if it "might mean several different things and no informed and confident choice is among the contending definitions." *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1371 (Fed. Cir. 2014). A patent claim that is indefinite is invalid. 35 U.S.C. § 282(b)(3)(A).

IV. THE ASSERTED PATENTS

A. The '764 Patent

The '764 patent, entitled "Pixel Isolation Elements, Devices and Associated Methods" issued on June 23, 2015 to Martin U. Pralle, Jeffrey McKee, and Jason Sickler. The '764 patent is assigned to SiOnyx.[2] The '764 patent generally relates "to improved designs for cameras, image sensors, and other sensors with pixels." Complaint at ¶ 43. According to the Complaint, "the patents teach improvements to the light-trapping pixels that are the foundation of cameras and other imaging devices." *Id.* The improvements of the '764 patent include "using trench isolation structures to electrically and optically isolate pixels from one another to reduce crosstalk and improve performance." *Id.* The patent also teaches that the isolation element can be designed to include "at least two layers (216) comprised of [a] material having a lower refractive index (n) as compared to the material of the third layer 218 disposed or sandwiched therebetween." '764 patent at 8:16-21. It also states: "A variety of reflective material can be utilized in constructing the

[2] The patent is assigned to SiOnyx, Inc. The complaint represents that SiOnyx, Inc. converted to SiOnyx, LLC on August 4, 2015. Complaint at ¶ 21; Complaint Ex. 10.

isolation features in order to provide optical isolation, light trapping, and/or electrical isolation[.]" *Id*. at 7:47-49.

The '764 patent has 25 claims. Claims 8-11, 14-16, 18 and 20 have been asserted in this Investigation. SiOnyx additionally asserts that the Domestic Industry Products practice claims 17, 21, 23, and 25. Mot. at 3. The claims read as follows (with the disputed terms highlighted in **bold** and the agreed-upon term <u>underlined</u>):

8. A light trapping device, comprising:

   at least one **light sensitive pixel** having a light incident surface, a backside surface opposite the light incident surface, and a peripheral <u>sidewall</u> disposed into at least a portion of the pixel and extending at least **substantially** around the pixel periphery;

   a backside light trapping material **substantially** covering the backside surface; and

   a peripheral light trapping material **substantially** covering the peripheral <u>sidewall</u>,

   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, and wherein the difference in refractive index between the first material and the two second materials is at least 0.2, 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.

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

15. The device of claim 8, wherein the peripheral <u>sidewall</u> 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. A light trapping device, comprising:

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;

a backside light trapping material **substantially** covering the backside surface; and

a peripheral light trapping material **substantially** covering the peripheral sidewall, 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, 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.

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. A light trapping device, comprising:

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;

a backside light trapping material **substantially** covering the backside surface; and

a peripheral light trapping material **substantially** covering the peripheral sidewall, and

a textured layer positioned to interact with light proximal to the backside surface, wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel.

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

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.

B. The ’599 Patent

The ’599 patent, entitled “Pixel Isolation Elements, Devices and Associated Methods” issued on February 27, 2018 to Martin U. Pralle, Jeffrey McKee, and Jason Sickler. The ’599 patent is assigned to SiOnyx. The ’599 patent is from the same family as the ’764 patent.

The ’599 patent has 36 claims. Claims 1, 4-8, 11 and 18 have been asserted in this Investigation. SiOnyx additionally asserts that the Domestic Industry Products practice claims 19, 22, 23, 26, 30, and 33. Mot. at 3. The claims read as follows (with the disputed terms highlighted in **bold** and the agreed-upon term <u>underlined</u>):

1. A light trapping device, comprising:

   at least one **light sensitive pixel** having a light incident surface, a backside surface opposite the light incident surface, and a peripheral <u>sidewall</u> extending at least partially around the pixel periphery;

   a backside light trapping material at least partially covering the backside surface;

   a peripheral light trapping material **substantially** covering the peripheral <u>sidewall</u>, wherein said peripheral light trapping material is doped with a dopant to create a surface field; and

   a reflective layer coupled to the light incident side and having an aperture to allow entry of light into the pixel;

   wherein the reflective layer is operable to reflect at least a portion of light impinging **thereupon from inside the pixel back into the pixel back into the pixel.**

4. The device of claim 1, wherein said peripheral light trapping material includes a member selected from the group consisting of an oxide, a nitride, oxynitrides, a gas, at least a partial vacuum, and combinations thereof.

5. The device of claim 4, wherein said peripheral light trapping material is selected from the group consisting of silicon oxide, silicon nitride, silicon dioxide, and combinations thereof.

6. The device of claim 1, wherein the dopant is boron or antimony.

7. The device of claim 1, wherein the peripheral <u>sidewall</u> extends completely around the pixel periphery.

8. The device of claim 1, wherein the peripheral <u>sidewall</u> extends from the light incident surface to the backside surface.

11. 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.

18. The device of claim 1, wherein said peripheral <u>sidewall</u> extends through the pixel **substantially** from the light incident surface to the backside surface.

19. A light trapping device, comprising:

at least one **light sensitive pixel** having a light incident surface, a backside surface opposite the light incident surface, and a peripheral sidewall extending at least partially around the pixel periphery;

a backside light trapping material at least partially covering the backside surface;

a peripheral light trapping material **substantially** covering the peripheral sidewall;

a textured region positioned to interact with light incident thereon to increase quantum efficiency of the device; and

a reflective layer coupled to the light incident side and having an aperture to allow entry of light into the pixel;

wherein the reflective layer is operable to reflect at least a portion of light impinging **thereupon from inside the pixel back into the pixel back into the pixel**.

22. The device of claim 19, wherein said peripheral light trapping material includes a member selected from the group consisting of an oxide, a nitride, oxynitrides, a gas, at least a partial vacuum, and combinations thereof.

23. The device of claim 22, wherein said peripheral light trapping material is selected from the group consisting of silicon oxide, silicon nitride, silicon dioxide, and combinations thereof.

26. The device of claim 19, wherein the peripheral sidewall extends completely around the pixel periphery.

30. The device of claim 19, wherein at least one of the backside light trapping material and the peripheral light trapping material is a metal layer.

33. The device of claim 19, wherein the peripheral light trapping material comprises any of aluminum oxide and hafnium oxide.

C. The ’359 Patent

The ’359 patent, entitled “Pixel Isolation Elements, Devices and Associated Methods” issued on March 5, 2019 to Martin U. Pralle, Jeffrey McKee, and Jason Sickler. The ’359 patent is assigned to SiOnyx. The ’359 patent is from the same family as the ’764 patent.

The ’359 patent has 83 claims. Claims 1, 5, 6, 8, 11, 18, 23, 24, 41, 44, 48, 54, 55, 60, 61, 64, 68, 69, 70, 74, 75, 80, and 82 have been asserted in this Investigation. SiOnyx additionally asserts that the Domestic Industry Products practice claims 7, 12-14, and 19. Mot. at 3. The claims read as follows (with the disputed terms highlighted in **bold**). Additionally, several of the asserted

claims depend on non-asserted claims. Accordingly, these non-asserted claims (claims 38, 45-47, 67, and 73) are also included below:

1. **An imager device**, comprising:

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

   a peripheral isolation element at least partially separating said two adjacent light sensitive pixels;

   each of said pixels having at least one doped region disposed on at least one of the light incident surface and the backside surface;

   wherein the peripheral isolation element comprises at least two materials having different indices of refraction,

   wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.

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.

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.

18. An **imager device**, comprising:

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

a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction,

at least one doped region disposed on at least one of the light incident surface and the backside surface,

wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and 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.

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.

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**.

41. The device of claim 38, where in 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.

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

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.

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.

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.

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 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.

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.

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

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

D. The ’714 Patent

The ’714 patent, entitled “Pixel Isolation Elements, Devices and Associated Methods” issued on August 8, 2023 to Martin U. Pralle, Jeffrey McKee, and Jason Sickler. The ’714 patent is assigned to SiOnyx. The ’714 patent is from the same family as the ’764 patent.

The ’714 patent has 18 claims. Claims 1-6, 9-13, 17, and 18 have been asserted in this Investigation. The claims read as follows (with the disputed terms highlighted in **bold** and the agreed-upon term <u>underlined</u>):

1. A light trapping device, comprising:

   at least one **light sensitive pixel** having a light incident surface, a backside surface opposite the light incident surface, and a peripheral <u>sidewall</u> disposed into at least a portion of the pixel and extending at least **substantially** around the pixel periphery;

   a backside light trapping material at least partially covering the backside surface; and

   a peripheral light trapping material **substantially** covering the peripheral <u>sidewall</u>;

   wherein light contacting the backside light trapping material or the peripheral light trapping material is reflected back toward the pixel;

   wherein at least one of the backside light trapping material or the peripheral light trapping material include a **high refractive index material** sandwiched between two **low refractive index materials**.

2. The device of claim 1, wherein the two **low refractive index materials** have a refractive index of less than about 2.1.

3. The device of claim 2, wherein at least one of the two **low refractive index 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.

4. The device of claim 2, wherein the at least one of the two **low refractive index materials** includes a member selected from the group consisting of silicon oxide, silicon nitride, silicon dioxide, and combinations thereof.

5. The device of claim 1, wherein the **high refractive index material** includes a material having a refractive index of greater than or equal to about 2.1.

6. The device of claim 5, wherein the **high refractive index 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.

9. The device of claim 1, 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, and wherein the difference in refractive index between the first material and the two second materials is at least 0.2.

10. The device of claim 1, wherein the peripheral sidewall extends completely around the pixel periphery.

11. The device of claim 1, wherein the peripheral sidewall extends from the light incident surface to the backside surface.

12. The device of claim 1, further comprising a frontside light trapping material at least partially covering the light incident surface.

13. The device of claim 12, wherein the frontside light trapping material is an antireflective layer coating.

17. 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.

18. The device of claim 1, 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.

E. The ’737 Patent

The ’737 patent, entitled “Shallow Trench Textured Regions and Associated Methods” issued on July 20, 2021 to Homayoon Haddad and Jutao Jiang. The ’737 patent is assigned to SiOnyx. The ’737 patent “also teaches improved designs for cameras, image sensors, and other sensors with pixels.” Complaint at ¶ 44. According to the Complaint, “the Patent describes the use of surface features to increase the path length of electromagnetic radiation in the devices and thereby also increase the device’s ability to absorb the radiation.” *Id.* The complaint further states that “[t]he surface features can include cones, pillars, pyramids, inverted features, trenches, gratings, protrusions, and similar. The Patent teaches that these features can also be lined with various materials to further improve the optical characteristics of the devices.” *Id.*

The ’737 patent has 55 claims. Claims 2-4, 6, 7, 12, 13, 16, 18, 20-22, 24, 26, 28-30, 33, 35, 38, 43-45, 48, 50-52, and 54 have been asserted in this Investigation. SiOnyx additionally asserts that the Domestic Industry Products practice claims 5, 19, 36, 39, and 49. Mot. at 3. The claims read as follows (with the disputed terms highlighted in **bold**). Additionally, several of the asserted claims depend on non-asserted claims. Accordingly, these non-asserted claims (claims 1, 15, and 32) are also included below:

1. **A photosensitive imager device capable of detecting visible and infrared electromagnetic radiation**, comprising:

   a semiconductor layer having a light incident side and an opposed side, said semiconductor layer having multiple doped regions forming at least one junction,

   a textured region comprising a plurality of surface features configured to interact with incident electromagnetic radiation so as to increase the quantum efficiency of the device, wherein the surface features are arranged according to a pattern,

   a support substrate coupled to said semiconductor layer, and

   a first bonding layer disposed between the semiconductor layer and the support substrate.

2. The device of claim 1, wherein the textured region is located on the light incident side of the semiconductor layer.

3. The device of claim 2, further comprising a device layer coupled to the semiconductor layer on said side opposed to the light incident side.

4. The device of claim 2, wherein the textured region is formed by etching.

5. The device of claim 4, wherein said surface features comprise pyramids.

6. The device of claim 2, further comprising a reflector layer disposed between **the textured layer** and the support substrate.

7. The device of claim 1, further comprising deep trench isolation for isolating the device.

12. The device of claim 1, wherein the surface features have a **substantially** uniform height.

13. The device of claim 1, wherein the surface features are not uniform in height.

15. The device of claim 1, wherein said semiconductor layer has a thickness in a range of about 1 micron to about 10 microns.

16. The device of claim 15, wherein the device exhibits a quantum efficiency of at least about 35% for electromagnetic radiation at a wavelength of about 940 nm.

18. The device of claim 1, wherein said plurality of surface features have a height in a range of about 50 nm to about 2 microns.

19. The device of claim 1, wherein said plurality of surface features have a height in a range from about 0.35 microns to about 0.7 microns.

20. The device of claim 1, wherein said plurality of surface features are formed by using a patterned mask and photolithography followed by etching.

21. The device of claim 1, wherein said plurality of surface features comprise multiple etched levels.

22. The device of claim 1, wherein said textured region increases optical absorption of the semiconductor layer over an electromagnetic spectrum range of at least about 700 nm to about 1100 nm.

24. The device of claim 1, wherein the patter is an at least **substantially** uniform grid.

26. A method of making a photosensitive image device, comprising:

providing a semiconductor layer having a light incident side and an opposed side, said semiconductor layer having multiple doped regions forming at least one junction;

providing a support substrate;

bonding the semiconductor layer to the support substrate;

creating a plurality of surface features on one of the semiconductor layer and the support substrate, wherein the surface features are formed via etching;

depositing an oxide material within at least a portion of the semiconductor layer or support substrate removed during etching; and

processing the region of the semiconductor layer or support substrate comprising the surface features with CMP after depositing the oxide material.

28. The method of claim 26, wherein bonding the plurality of surface features are formed on the light incident side of the semiconductor layer.

29. The method of claim 26, wherein depositing the oxide material comprises at least partially filling one of trenches, holes, pits, and cones formed in the semiconductor layer during etching,

30. The method of claim 26, wherein the surface features are formed by shallow trench isolation etching.

32. **A photosensitive imager device capable of detecting visible and infrared electromagnetic radiation**, comprising:

a semiconductor layer having a light incident side and an opposed side, said semiconductor layer having multiple doped regions forming at least one junction,

a textured region comprising a plurality of surface features configured to interact with incident electromagnetic radiation so as to increase the quantum efficiency of the device,

a support substrate coupled to said semiconductor layer, and

a first bonding layer disposed between the semiconductor layer and the support substrate,

wherein the device exhibits a quantum efficiency of at least about 35% for electromagnetic radiation at a wavelength of about 940.

33. The device of claim 32, wherein the textured region is located on the light incident side of the semiconductor layer.

35. The device of claim 33, wherein the textured region is formed by etching.

36. The device of claim 35, wherein said surface features comprise pyramids.

38. The device of claim 32, further comprising deep trench isolation for isolating the device.

39. The device of claim 38, wherein said deep trench isolation provides light trapping functionality.

43. The device of claim 32, wherein the surface features have a **substantially** uniform height.

44. The device of claim 32, wherein the surface features are not uniform in height.

45. The device of claim 32, wherein said first bonding layer comprises any of silicon oxide, silicon nitride, and amorphous silicon.

48. The device of claim 32, wherein said plurality of surface features have a height in a range of about 50 nm to about 2 microns.

49. The device of claim 32, wherein said plurality of surface features have a height in a range from about 0.35 microns to about 0.7 microns.

50. The device of claim 32, wherein said plurality of surface features are formed by using a patterned mask and photolithography followed by etching.

51. The device of claim 32, wherein said plurality of surface features comprise multiple etched levels.

52 The device of claim 32, wherein said textured region increases optical absorption of the semiconductor layer over an electromagnetic spectrum range of at least about 700 nm to about 1100 nm.

54. The device of claim 32, wherein the surface feature are arranged according to a pattern that is an at least **substantially** uniform grid.

V. LEVEL OF ORDINARY SKILL IN THE ART

SiOnyx asserts that one of skill in the art would have "at least a bachelor's degree in electrical engineering, materials science, or physics (or an equivalent degree), at least two years of experience in optoelectronics, and at least three years of work experience in semiconductor manufacturing." CMIB at 5. SiOnyx further states that "a master's degree or Ph.D. in a relevant field may substitute for some work experience or vice versa" *Id.*

Samsung asserts that one of skill in the art would have "a Bachelor's degree in engineering, physics, or a related equivalent field, and two or more years of experience researching, developing, designing, and/or evaluating image sensors using photonics." RMIB at 7. Samsung further states: "A person with less or different education but more relevant practical experience, or vice versa, may also meet this standard." *Id.*

The main difference[3] between the parties' proposals is SiOnyx's suggestion that one of skill should have "at least three years of work experience in semiconductor manufacturing." SiOnyx asserts that such a requirement is necessary because "[t]he Asserted Patents teach improvements to the way that optoelectronic devices are made, *e.g.*, through isolation structures." CMIB at 6. According to SiOnyx, the patents "assume knowledge of standard semiconductor

[3] While SiOnyx's proposal is directed to "optoelectronics," Samsung asserts that its proposal is equivalent. RMIB at 7 ("With one exception – three years of manufacturing experience – SiOnyx's proposed level of skill is roughly equivalent to Samsung's proposal.").

manufacturing processes." *Id.* SiOnyx references the following portions of the specification in support of its argument:

> [T]he surface features can be formed by any number of shallow trench isolation (STI) techniques. While such manufacturing techniques are known, they have previously been utilized for creating regions of electrical isolation between circuit elements." '737 patent at 8:66-9:3.
>
> The process contemplated for forming trenches or other isolation features can include, reactive ion etch, isotropic plasma etch, wet chemical etch, laser irradiation, or any other known etch technique. '764 patent at 7:43-46.

CMIB at 6.

While the specifications do suggest that one of skill would have knowledge of semiconductor manufacturing, they do not indicate that one would need actual experience in manufacturing itself. A person of skill may develop knowledge of different manufacturing processes through either education or through other work experience. As Samsung's expert, Dr. Adam Fontecchio, explained: "[M]any engineers who design optoelectronic devices do not have three years of manufacturing experience. For example, engineers who work at fabless semiconductor companies, which rely on a third-party to manufacture the company's chip designs, typically have little to no manufacturing experience." Opp. Ex. P at ¶ 25. I therefore decline to include a requirement that includes actual manufacturing experience.

Accordingly, I find that a person of ordinary skill in the art would have at least a bachelor's degree in electrical engineering, materials science, or physics (or an equivalent degree) and at least two years of experience in optoelectronics. The person should have knowledge of standard semiconductor manufacturing processes. A higher level of education may substitute for a lesser amount of experience, and vice versa.

VI. CLAIM CONSTRUCTION

A. Construction of Agreed-Upon Claim Terms

The parties have agreed to the following construction:

CLAIM TERM	RELEVANT CLAIMS	PARTIES' AGREED CONSTRUCTION
"sidewall"	'764 patent: claims 1, 8, 14-15, 17-18, 21, 23 '599 patent: claims 1, 7-8, 18-19, 26 '714 patent: claims 1, 10-11	Plain and ordinary meaning. To the extent a construction is required: trench wall

JC at 2. I hereby adopt the parties' proposed construction and shall construe the term set forth above according to its agreed-to definition.

B. Construction of the Disputed Claim Terms

1. "a textured layer positioned to interact with light proximal to the backside surface"

The term "a textured layer positioned to interact with light proximal to the backside surface" appears in claim 21 of the '764 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
Plain and ordinary meaning. To the extent a construction is required: a layer that includes features that increase the path length of incident light that reaches the backside surface	a textured layer disposed on the backside surface

JC at 2.

SiOnyx asserts that "[t]he primary words in this term were well understood in the art at the time of the invention, and thus do not require construction." CMIB at 7. SiOnyx explains that

"[t]he primary dispute between the parties centers on the word 'proximal,' and whether it is modifying the immediately preceding word, 'light,' or instead modifying 'textured layer.'" *Id.* According to SiOnyx, "[t]he natural reading of the term is that the phrase 'light proximal to the backside surface' is a single logical unit that the 'textured layer' is 'positioned to interact with.'" *Id.* SiOnyx also notes that it "was well aware of how to claim a material that is 'disposed on' the backside surface" as "it does so elsewhere in the very same claim." *Id.* The fact that SiOnyx chose not to "describe the textured layer in this manner" shows that there "is no requirement that the textured layer be on the backside." *Id.* at 8. SiOnyx further explains that its "reading is entirely consistent with the specification."

Samsung asserts that its construction "applies the plain meaning of the claim language, is consistent with the specification, and is consistent with even SiOnyx's expert opinion." RMIB at 8. Samsung also asserts that SiOnyx's position "ignores the 'positioned' requirement of the claim." *Id.* According to Samsung: "For the textured layer to be 'positioned to interact' with light on the backside, the textured layer too must be on the backside." *Id.* at 8-9. "Otherwise . . . it would not be able to interact with the light there." *Id.* at 9. Samsung further asserts that "[t]he specification consistently describes texturing as being on the backside surface, with the light interacting there." *Id.* It also argues that SiOnyx's expert, Dr. Daniel Foty, testified that it makes no sense to position the textured layer on the light incident side and that the claim term refers to positioning this layer on the backside surface. *Id.* at 10.

I decline to construe this term at the present time. I will address this construction in the final initial determination.

2. "light sensitive pixel"/"light sensitive image sensor pixels"

The terms "light sensitive pixel"/"light sensitive image sensor pixels" appear in claims 8, 17 and 21 of the '764 patent, claims 1 and 19 of the '599 patent, claims 1 and 18 of the '359 patent,

and claim 1 of the '714 patent. The terms also appear in claims which SiOnyx does not assert, but upon which asserted claims depend (claims 38 and 45-47 of the '359 patent). The parties disagree on the claim construction of these terms and have proposed the following constructions:

SiOnyx	RESPONDENTS
Plain and ordinary meaning. To the extent a construction is required: element(s) of an image sensor that converts light into an electrical signal	photodiode capable of detecting light

JC at 2.

SiOnyx asserts that "[t]he term 'pixel' is well known to those of skill in the art." CMIB at 8. SiOnyx further argues that "the specification does not redefine" the term. *Id*. SiOnyx notes that "pixel" is "used throughout the specification because POSITAs understand its meaning without a definition." *Id.* at 9. SiOnyx states that "Samsung's proposal, on the other hand, seeks to change 'pixel' to 'photodiode,' even though the patentee expressly chose to claim a pixel." *Id.*

Samsung asserts that "the intrinsic and extrinsic evidence demonstrate that 'pixel' means photodiode – which all parties agree is what coverts light into electrical signals." RMIB at 12. According to Samsung, the intrinsic record "uses the terms 'pixel' and 'photodiode' interchangeably." *Id.* 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." *Id.* at 15. Samsung asserts that SiOnyx's construction "injects uncertainty into the metes and bounds of 'pixel' and captures unidentified, structural elements that do not convert light to electrical signals.'" *Id.* at 12.

"[T]he words of a claim are generally given their ordinary and customary meaning." *Phillips*, 415 F.3d at 1312-1313. As the Federal Circuit explained in *Interdigital Communications*

LLC v. International Trade Commission, "[t]he plain meaning of claim language ordinary controls unless the patentee acts as his own lexicographer and provides a special definition for a particular term or the patentee disavows the ordinary scope of a claim term either in the specification or during prosecution." 690 F.3d 1318, 1324 (Fed. Cir. 2012) (citing *Philips*, 415 F.3d at 1316).

The parties do not dispute that the term "pixel"[4] has an ordinary meaning to one of skill.[5] While Samsung argues that construction is necessary to determine the metes and bounds of the plain and ordinary meaning, its proposed construction aims to specifically limit the term. For Samsung's construction to be appropriate, however, there must be evidence that either the patentee acted as its own lexicographer or there was disavowal of claim scope during prosecution. Samsung has not provided evidence that either of these exceptions applies.

Samsung argues that the patent "uses the terms 'pixel' and 'photodiode" interchangeably." RMIB at 12. Samsung acknowledges that "photodiode" also has a recognized meaning to one of skill in the art. *Id.* at 15. Thus, for one of skill to understand that these distinct terms are to be used interchangeably in the context of the patent, there would need to be clear evidence of such intent. *See, e.g.*, *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014) ("a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning" and must "clearly express an intent to redefine the term"). Here, there is no such evidence. Samsung cites, for example, statements in which the patent refers to both pixels and

[4] While the full term includes either "light sensitive" or "light sensitive image sensor" before the word "pixel," the parties' dispute focuses on the word "pixel" itself. *See* CMIB at 8 ("The term 'pixel' is well known to those of skill in the art and the specification does not redefine it."); RMIB at 12 ("[T]he intrinsic and extrinsic evidence demonstrate that 'pixel' means photodiode.").

[5] Dr. Foty opines that "'[l]ight sensitive pixel' and 'light sensitive image sensor pixels' are terms that are well-known (and well-understood) to a POSITA." CMIB Ex. 6 at ¶ 26. Dr. Fontecchio does not disagree. Instead, he argues that "[t]his term needs to be construed so that the parties have a clear definition to apply when evaluating the validity and alleged infringement of the asserted claims." RMIB Ex. P at ¶ 32.

photodiodes. *See* RMIB at 12-13 (citing ’764 patent at 8:7-9 (“an imager having at least two pixels or photodiodes (202 and 204)”); *id.* at 6:36 (“neighboring pixels or photodiodes”), 6:40-41 (“a plurality of photodiodes or pixels”)). These statements can be read to indicate that the invention can include either photodiodes *or* pixels. As SiOnyx explains: “‘[O]r’ is more naturally (or at least as easily) read in its disjunctive form to mean that pixels and photodiodes are two different options, or at most that a pixel may contain a photodiode.” CMRB at 5. While it is possible that these statements could also be read as evidence that the patentee intended for the terms to be synonyms, there is no clear statement of such intent.

Samsung also notes that the specification incorporates by reference U.S. Patent App. No. 13/069,135 (“Alie”). RMIB at 13. According to Samsung, “Figure 5 of Alie discloses a structure . . . closely resembling the structure of the individual ‘pixels or photodiodes (202 and 204)’ that are depicted in Figure 2” of the ’764, ’599, ’359, and ’714 patents. *Id.*

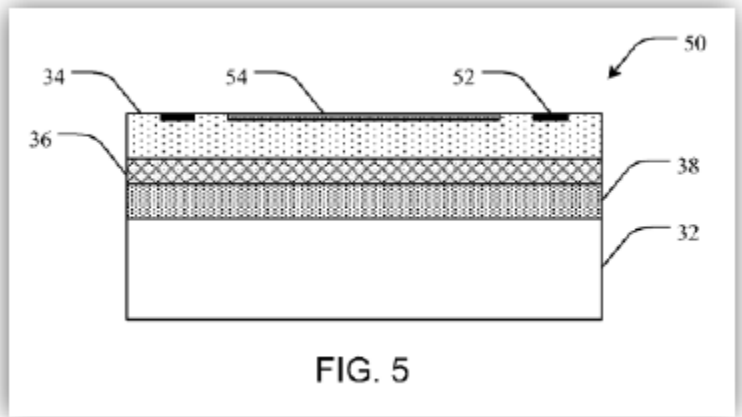

FIG. 5

RMIB Ex. A. Samsung explains that “Alie labels element 50 as a “photodiode” comprising a “photodiode junction 54 formed on the semiconductor layer 34” and a “textured region 36.” *Id.* (quoting RMIB Ex. A at ¶ [0096]). This is certainly not a clear statement indicating an intent to explicitly redefine “pixel” as “photodiode.” As SiOnyx notes: “Alie does not use the word ‘pixel’

even once and Samsung provides no explanation, other than attorney argument, for why a POSITA would nonetheless understand it to be relevant to the meaning of 'pixel.'" CMRB at 5-6.

I further disagree that the prosecution history demonstrates that the patentee disavowed the full scope of "pixel" and instead limited the meaning to "photodiode." Samsung cites to a rejection of claims in view of U.S. Patent Pub. No. 2013/0200251 ("Velichko"). RMIB at 14. According to Samsung, Velichko discloses a "photodiode" and the Examiner rejected the claimed "pixel" on this basis. *Id.* Upon review of the prosecution history, it is not clear if this was the Examiner's intent. The Examiner indicated that Velichko disclosed all the elements in the proposed claims, but did not cite to any specific disclosure of Velichko or provide an explanation as to how Velichko disclosed the claims. *See* Opp. Ex. J at SIONYX1403000004.0113 ("Claims 1, 12, 13, and 23 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Velichko (US pub 20130200251)"). To find that this history demonstrated a disavowal of claim scope, I would need to assume that the Examiner believed that a disclosure of a photodiode was equivalent to a pixel and then assume that the Examiner rejected the claim on this basis. It is, however, improper to rely on assumptions when analyzing prosecution disavowal. *See Digital-Vending Servs. Int'l, LLC v. Univ. of Phoenix, Inc.*, 672 F.3d 1270, 1276 (Fed. Cir. 2012) (explaining that "it is particularly important not to limit claim scope based on statements made during prosecution absent a clear disavowal or contrary definition").

For these reasons, I find that there is no evidence that the patentee intended to depart from the plain and ordinary meaning of "pixel." *See Interdigital*, 690 F.3d at 1324 (explaining that "[t]he normal rule giving claim terms their ordinary meaning" governs because there was no evidence that either the specification or the prosecution history contained a restrictive definition of "code").

Samsung contends that a construction is still necessary because it needs to understand the boundaries of the term "pixel." According to Samsung, "[f]ailing to construe the term . . . will lead to confusion and disputes at later stages of the proceeding over what is and is not part of the claimed 'pixel.'" RMRB at 3. I am cognizant of the Federal Circuit's mandate that "[w]hen the parties present a fundamental dispute regarding the scope of a claim term, it is the court's duty to resolve it." *O2 Micro Intern. Ltd. v. Beyond Innovation Technology Co., Ltd.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008). I find that it is premature to further address the scope of "pixel" at this stage, however.

First, I note that Samsung argues that adopting SiOnyx's proposed construction results in the same problem. *See id.* at 5 (asserting that SiOnyx's construction likewise "fails to elucidate the pixel boundaries"). Samsung does not, however, offer an alternative construction. Thus, to address Samsung's concern that the metes and bounds of "pixel" need to be clarified, I would need to arrive at my own definition of "pixel." I decline to do so at this stage.

Second, Samsung's complaint here appears not to be about the meaning of "pixel" itself but is instead about the application of the term "pixel." Whether a particular structure is part of a "pixel" is akin to an infringement analysis, which is a separate inquiry from claim construction.[6] *See Markman*, 52 F.3d at 976. I will consider the parties' arguments with respect to whether a person of ordinary skill in the art would understand a given structure to meet the term "pixel" when I analyze infringement in the final initial determination. If, in conducting this analysis, it is necessary to explicitly define the plain and ordinary meaning of "pixel," I will do so.

[6] In its opening brief, for example, Samsung addresses whether a lens, wiring lines, and processing circuitry can be considered a pixel. RMIB at 15.

For these reasons, I find that "light sensitive pixel" and "light sensitive image sensor pixels" should be given their plain and ordinary meaning.

3. "high refractive index material"/"low refractive index material"

The terms "high refractive index material"/"low refractive index material" appear in claims 1-6 of the '714 patent. The parties disagree on the claim construction of these terms and have proposed the following constructions:

SiOnyx	RESPONDENTS
Material that has a refractive index of greater than 2.1 and/or that has a refractive index that is at least 0.2 greater than the [low refractive index material[s]]	material that has a refractive index of greater than or equal to 2.1
Material that has a refractive index of less than 2.1 and/or has a refractive index that is at least 0.2 less than the [high refractive index material]	material(s) that have a refractive index less than 2.1

JC at 3.

SiOnyx explains that "[t]hese terms refer to the 'light trapping material,' which the claims specify must 'include a high refractive index material sandwiched between two low refractive index materials.'" CMIB at 13. SiOnyx argues that the specification "describes the makeup of the light trapping material in two ways." *Id.* First, it describes that "the high refractive index material has an index of refraction greater than or equal to 2.1 and the low refractive index material has an index of refraction less than 2.1." *Id.* Second, it describes the high and low materials as relative to each other, with the "higher refractive index material . . . having a refractive index that is at least 0.2 lower as compared to the higher refractive index material." *Id.* SiOnyx asserts that it would be improper to construe the claims to exclude the second embodiment "absent probative evidence on the contrary." *Id.* at 14 (quoting *Oatey Co. v. IPS Corp.*, 514 F.3d 1271, 1277 (Fed. Cir. 2008)).

SiOnyx also argues that its proposed construction is supported by the doctrine of claim differentiation. *Id.* It explains that "Samsung's proposed construction is identical to what is already required by claim 2." *Id.* As such, the proposal "would give claim 2 the exact same scope as claim 1, which is improper." *Id.*

Samsung disagrees that the embodiment shows that materials with a refractive index of less than 2.1 can include both high refractive index material and low refractive index material. RMIB at 18-19. Samsung notes that the specification uses the words "high" and "low" when referring to refractive index materials "in absolute terms (*i.e.*, less than 2.1 or greater than or equal to 2.1)," and the words "higher" and "lower" when describing the layers "based on the relative difference in refractive index." *Id.* at 19. Samsung argues that "the inventors disclosed two different ways to characterize materials based on their refractive indexes . . . but they chose to claim only the first approach." *Id.* at 20.

The parties agree that the patent discloses two ways to characterize light trapping materials based on their refractive indexes. CMIB at 13; RMIB at 20 ("At bottom, the inventors disclosed two different ways to characterize materials based on their refractive indexes…"). For the first approach, the patent indicates that the high refractive index material has an index of refraction greater than or equal to 2.1 and the low refractive index material has an index refraction of less than 2.1:

> It is contemplated that the two low refractive index materials have a refractive index of less than about 2.1 . . . Furthermore, it is contemplated that high refractive index materials have a refractive index of greater than or equal to about 2.1.

'714 patent at 2:2-4, 2:17-19; *see also id.* at 10:33-44, 10:52-62. For the second approach, the patent describes the high and low materials as defined relative to one another:

> Furthermore, in another aspect an isolation element or light trapping material can include a higher refractive index material sandwiched between two materials

> having a refractive index that is at least 0.2 lower as compared to the higher refractive index material.

'714 patent at 8:47-51. Samsung contends, however, that the patentee "chose to claim only the first approach." RMIB at 20.

The Federal Circuit has explained that courts should normally "not interpret claim terms in a way that excludes embodiments disclosed in the specification." *Oatey*, 514 F.3d at 1277. "At least where claims can reasonably be interpreted to include a specific embodiment, it is incorrect to construe the claims to exclude that embodiment, absent probative evidence to the contrary." *Id.* I find that the evidence does not support a finding that the second embodiment should be excluded.

Samsung first argues that a construction that covers the second approach would be "contrary to the specification." RMIB at 19. As Samsung itself admits, however, the specification describes two ways to characterize the materials. *Id.* Something cannot be both described in the specification and be "contrary to the specification."

Samsung next argues that "[w]hen the specification describes layers based on the relative difference in refractive index [as set forth in the second approach], it uses the words 'lower' and 'higher.'" RMIB at 19. Samsung argues that because the claim terms use the words "low" and "high," the patentee signified that "these terms refer to an absolute measurement of the refractive index [as set forth in the first approach]." *Id.*

The dependent claims demonstrate that this understanding is incorrect. Dependent claims 2 and 5 read as follows:

> 2. The device of claim 1, wherein the two low refractive index materials have a refractive index of less than about 2.1.
>
> 5. The device of claim 1, wherein the high refractive index material includes a material having a refractive index of greater than or equal to about 2.1.

’714 patent at cls. 2, 5. If Samsung were correct that the patentee intended a “low refractive index material” to be a material that has a refractive index of less than 2.1 and a “high refractive index material” to be a material that has refractive index greater than or equal to 2.1, these dependent claims would be redundant. Instead, the inclusion of the limitation in the dependent claims demonstrates that the independent claim is not so limited. *See Phillips*, 415 F.3d at 1315 (“the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.”)

Samsung suggests that I should ignore the existence of these dependent claims, as “the doctrine of claim differentiation ‘does not serve to broaden claims beyond their meaning in light of the specification and does not override clear statements of scope in the specification and the prosecution history.” RMRB at 8 (quoting *Toro Co. v. White Consol. Indus., Inc.*, 199 F.3d 1295, 1302 (Fed. Cir. 1999)). Samsung has not, however, pointed to any “clear statement” of scope in the intrinsic record. As noted above, there is nothing that amounts to a clear exclusion of the second embodiment. Additionally, the Federal Circuit has explained that “[t]he doctrine of claim differentiation is at its strongest in this type of case, ‘where the limitation that is sought to be ‘read into’ an independent claim already appears in a dependent claim.’” *Interdigital*, 690 F.3d at 1324 (quoting *Libel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004). Further, the presumption of claim differentiation is “especially strong” where, as here, “the limitation in dispute is the only meaningful difference between an independent and dependent claim, and one party is urging that the limitation in the dependent claim should be read into the independent claim.” *Id.* (quoting *SunRace Roots Enter. Co., Ltd. v. SRAM Corp.*, 336 F.3d 1298, 1303 (Fed. Cir. 2003)). As such, I find that the intrinsic record does not support Samsung’s understanding of the use of low/high versus lower/higher.

Finally, Samsung argues that "SiOnyx's overbroad construction would lead to nonsensical results." RMIB at 19. Samsung explains:

> For example, if a first material has a refractive index of 2.2 and a second material has a refractive index of 2.5, the first material would be *both* a "high" refractive index material (because its value is greater than 2.1), *and* a "low" refractive index material (because its refractive index is 0.3 less than the index of the second material).

Id. (emphasis in original). This scenario would not lead to a nonsensical result, however, if one considers the embodiments described in the patent to be alternatives of one another. The patent explicitly states that this is the case. After describing the embodiment in which the high and low materials are defined relative to each other, the patent states:

> In this case, the materials are not limited by the definition of low vs. high refractive index outlined below, but are rather defined by the relative different in refractive index. For example, in one aspect a light trapping material can include silicon dioxide/silicon nitride/silicon dioxide, each material of which would be considered to be a low refractive index material. There is, however, a greater than 0.2 difference in the refractive indexes between silicon dioxide and silicon nitride, and thus such an isolation element would be included within the present scope.

'714 patent at 8:52-60; *see also id.* at 2:9-13 ("Furthermore, in another aspect a light trapping material can include a higher refractive index material sandwiched between two materials having a refractive index that is at least 0.2 lower as compared to the higher refractive index materials. In this case, the materials are not limited by the definition of low vs. high refractive index outlined above, but are rather defined by the relative difference in refractive index."). As such, I do not find Samsung's argument persuasive.

Accordingly, I find that "high refractive index material" means "material that has a refractive index greater than 2.1 and/or that has a refractive index that is at least 0.2 greater than the low refractive index material(s)" and "low refractive index material" means "material that has a refractive index of less than 2.1 and/or has a refractive index that is at least 0.2 less than the high refractive index materials."

4. "substantially"

The term "substantially" appears in claims 8, 17, and 21 of the '764 patent, claims 1, 18, and 19 of the '599 patent, claim 5 of the '359 patent, and claim 1 of the '714 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
to the same overall result as if absolute and total completion were obtained	the complete or nearly complete extent or degree of an action, characteristic, property, state, structure, item, or result so as to have the same overall result as if absolute and total completion were obtained

JC at 3.

SiOnyx asserts that "[b]oth parties' proposed constructions are derived from the same passage in the specification," but that its proposal "should be adopted because it fits into the surrounding claim language." CMIB at 15. SiOnyx further asserts that "Samsung's construction picks and chooses only certain pieces of the full discussion of 'substantially' provided in the specification," but notes that "the claims already define the 'action, characteristic, property state, structure, item, or result' that must be substantially complete." *Id.* at 16.

Samsung argues that its proposal "reflects the explicit definition of this term provided in the specification." RMIB at 21. Samsung explains that its proposed construction "incorporates the two equally important requirements from this definition." *Id.* at 22. Samsung also argues that SiOnyx's proposal "disregards the first part of this express definition . . . and instead relies exclusively on the second part." *Id.*

When a patentee gives a special definition to a claim term that "differs from the meaning it would otherwise possess . . . the inventor's lexicography governs." *Phillips*, 415 F.3d at 1316. Here, the patentee gives a special definition to the term "substantially." It states: "As used herein,

substantially" refers to the complete or nearly complete extent or degree of an action, characteristic, property, state, structure, item or result." '764 patent at 5:12-14. As such, I must reject SiOnyx's proposed construction, which does not include this language.

The question becomes whether the construction should also include the language that follows this express definition. After setting forth the express definition, the patent continues:

> For example, an object that is 'substantially' enclosed would mean that the object is either completely enclosed or nearly completely enclosed. The exact allowable degree of deviation from absolute completeness may in some cases depend on the specific context. However, generally speaking the nearness of completion will be so as to have the same overall result as if absolute and total completion were obtained.

'764 patent at 5:14-21. Neither party proposes that the construction should include either the first or second sentences of the above passage. Both parties' proposals include the language in the third sentence: "the same overall result as if absolute and total completion were obtained." This does not mean, however, that the parties necessarily agree that the third sentence should be included in the term's construction.

Samsung describes the overall definition as having two parts: The first part of the definition (the express definition of "substantially") describes the degree and the second part (the third sentence in the above passage) describes the result. *See, e.g.*, RMIB at 22. At the *Markman* hearing, SiOnyx stated that it "would accept" the language in the express definition, but that the claim should not be construed to require both a degree and a result. Tr. at 84:14-19. Thus, SiOnyx contends that if I construe the term "substantially" with the language in the express definition, I should not also include the third sentence.

I find that it is improper to include the third sentence in the construction. The patent itself states that while, "generally speaking," it is true that "the nearness of competition will be so as to have the same overall result as it absolute and total competition were obtained," by the very

inclusion of the words "generally speaking," the patent indicates that this is not always the case. Rather, the patent instructs that one of skill will need to understand the specific context to determine "[t]he exact allowable degree of deviation from absolute completeness." '764 patent at 5:17-19. It would be improper for the construction to include a requirement that the patent itself indicates is not always present. I therefore decline to include the third sentence in the construction.

Finally, SiOnyx argues that I should not construe the term using the language set forth in the definition because the definition would "introduce redundant language." *See* CMIB at 15. SiOnyx asserts that "the claims already define the 'action, characteristic, property, state, structure, item, or result" and thus there is no need to specifically include that phrase. *Id.* at 16. I find this argument persuasive but note that the construction can be modified to reflect how substantially is used in context. The patent itself explains that it does not intend for the express definition of "substantially" to be applied word-for-word in a construction. Instead, the patent states: "For example, an object that is 'substantially' enclosed would mean that the object is either completely enclosed or nearly completely enclosed." '764 patent at 5:14-17.[7] Thus, the patent indicates that one of skill would apply the definition of "substantially" as set forth in the patent but modify it to the context of each use.

Accordingly, I find that "substantially" means "the complete or nearly complete extent or degree of an action, characteristic, property, state, structure, item or result." I decline, however, to construe the term in this manner, as each instance of "substantially" will need to have an individual construction tailored to the specific use.

[7] Samsung recognizes this in its brief. It notes that "not all of the alternatives ("action, characteristic, property, state, structure, item, or result") apply to every use of "substantially." RMIB at 22.

5. "thereupon from inside the pixel back into the pixel back into the pixel"

The term "thereupon from inside the pixel back into the pixel back into the pixel" appears in claims 1 and 19 of the '599 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
plain and ordinary meaning, meaning "such that the light is reflected internally to be effectively maintained inside the pixel"	plain and ordinary meaning, meaning that the light must bounce back into the pixel twice

JC at 3.

SiOnyx asserts that its "construction is appropriate to correct what is plainly an inadvertent drafting error." CMIB at 17. SiOnyx argues that "the other claims, summary, and specification of the patent . . . consistently use the phrase 'back into the pixel' only once." *Id.* SiOnyx further asserts that "there is no indication that either the patentee or the examiner relied on the mistaken repeated recitation of 'back into the pixel' during prosecution." *Id.* at 17-18. Finally, SiOnyx asserts that the language of the term "does not facially equate to Samsung's proposal." *Id.* at 18.

Samsung argues that its proposal "is based on the express language of the limitation and provides that light must bounce back into the pixel twice." RMIB at 23. Samsung contends that SiOnyx's proposal "would broaden the scope of the claim term by providing that the reflective layer be operable to reflect a portion of light impinging thereupon from inside the pixel back into the pixel only once, rather than twice." *Id.* Samsung also argues that SiOnyx's proposed construction fails both requirements of the test a court applies to determine if it can correct an alleged error in a patent. *Id.* at 23-24.

A district court can only correct an error in a patent if: "(1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the

prosecution history does not suggest a different interpretation of the claims." *Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1354 (Fed. Cir. 2003). The first step in the analysis, however, is to determine whether or not there is an error that needs to be corrected. *Pavo Sols. LLC v. Kingston Tech. Co., Inc.*, 35 F.4th 1367, 1373-1374 (Fed. Cir. 2022) ("We begin by addressing whether the claim language contains an obvious minor typographical or clerical error."). "The error must be evident from the face of the patent . . . and the determination must be made from the point of view of one skill in the art." *Id.* at 1373 (internal quotations and citations omitted).

I find that the inclusion of "back into the pixel" twice is an obvious minor typographical error. First, I note that the only testimony from a person of ordinary skill in the art in the record indicates that the language includes an error. *See* CMIB Ex. 6 at ¶ 43 (declaration from Dr. Foty noting "the double-instance of 'back into the pixel' is clearly a typographical error"). Samsung did not introduce any testimony from its own expert to contradict this opinion, even though the determination of whether there is an error "must be made from the point of view of one of skill in the art." *Pavo Sols.*, 35 F.4th at 1373.

Next, I find that the language "back into the pixel back into the pixel" is nonsensical. If, as Samsung proposes, the patentee intended the claim to require that "the light must bounce back into the pixel twice," the correct way would be to so state – not to simply repeat the words twice. I am unaware of any language convention that would support the idea that it is common practice to include a phrase twice to express the idea that an action must occur twice. *See Pavo Solutions*, 35 F.4th at 1375 (explaining that a claim included a mistake, in part, because "the claim as written facially did not make sense").

This conclusion is supported by the fact that the other claims and specification use "back into the pixel" as opposed to "back into the pixel back into the pixel." *See, e.g.*, '599 patent at cl.

2 ("the peripheral light trapping material reflects light incident thereon back into the pixel"); cl. 20 (including same phrase as in claim 2). Likewise, this phrase "back into the pixel" appears three times in the specification, but the phrase "back into the pixel back into the pixel" is never used. *See* '599 patent at 2:28-33 ("In another aspect, the frontside light trapping material can be a reflective layer having an aperture to allow entry of light into the pixel, wherein the reflective layer is operable to reflect light impinging thereupon from inside the pixel back into the pixel"); *id.*at 2:45-50 ("Furthermore, an internally reflective frontside light trapping material can cover at least a portion of the light incident surface that is operable to allow entrance of light into the pixel and is operable to reflect the light impinging thereupon from inside the pixel back into the pixel."); *id.* at 12:2-3 ("The frontside light trapping material 632 is thus operable to reflect light impinging thereupon from inside the pixel 602 back into the pixel.") (emphasis added). The repeated usage of "back into the pixel" combined with the absence of the phrase "back into the pixel back into the pixel" supports a finding that claims 1 and 19 include a typographical error.

I am not persuaded by Samsung's argument that a passage in the specification supports its view that the phrase it not a mistake. First, as noted above, even if the patentee intended that the light must bounce back into the pixel twice, repeating the language "back into the pixel" is not a linguistically correct way of indicating this requirement. Additionally, the passage cited by Samsung describes Figure 6 and states:

> [T]he aforementioned pixel is reflective on 6 internal sides, and as such, light entering the pixel that is not absorbed will interact with and be reflected internally be[sic] either the backside, peripheral sidewall, or frontside light trapping materials. Light is thus effectively maintained inside the pixel until it is absorbed.

’599 patent at 12:25-31. At most, the passage can be read as being “consistent with reflecting at least some light twice.” [8] *See* RMIB at 24. The passage does not, however, clearly show that the patentee intended to require that light must bounce into the pixel twice.

Nor am I persuaded by Samsung’s argument that the prosecution history demonstrates that the repetition of “back into the pixel” was intentional. The applicant introduced the disputed language in claim 1 on June 22, 2016. Opp. Ex. O.

LISTING OF CLAIMS

1. (Currently Amended) A light trapping device, comprising:

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~~ partially around the pixel periphery;

a backside light trapping material at least partially covering the backside surface; and

a peripheral light trapping material substantially covering the peripheral sidewall,

a reflective layer coupled to the light incident side and having an aperture to allow entry of light into the pixel;

wherein the reflective layer is operable to reflect at least a portion of light impinging thereupon from inside the pixel back into the pixel back into ~~toward~~ the pixel.

Id. One month later, the Examiner rejected claim 1 as anticipated by Velichko. Opp. Ex. K at SIONYX1403000031.0042–0046. According to Samsung, “Velichko discloses that light can reflect into the pixel multiple times.” RMIB at 25. Thus, Samsung suggests that the Examiner

[8] I note that SiOnyx disagrees with Samsung’s understanding of this paragraph. SiOnyx asserts that this paragraph “refers to ‘the aforementioned pixel,’ which is the very embodiment, Fig. 6, that describes light reflecting ‘back into the pixel’ only once. . . Moreover, the cited portion is describing an embodiment where ***all six internal sides*** are reflective, ***each*** of which reflects light back into the pixel, while claims 1 and 19 are referring to a single ‘reflective layer coupled to the light incident side.” CMRB at 11 (emphasis in original).

understood the phrase "back into the pixel back into the pixel" to mean that the light must bounce back into the pixel twice and that such a limitation was already disclosed by Velichko. *Id.*

Samsung's argument rests on several assumptions. Even if all the assumptions were correct, the fact that the conclusion that Samsung wishes to draw is not explicitly stated is proof that there is not clear evidence that the repetition of "back into the pixel" was understood by the Examiner as intentional. It is also unclear if Samsung's assumptions are, in fact, correct. Samsung assumes that the Examiner believed that "back into the pixel back into the pixel" was intentional (as opposed to an inadvertent typographical error that went unnoticed) and assumes that the Examiner rejected the claim based on a particular passage in Velichko. These assumptions are not supported by clear statements in the record. The Examiner indicated that Velichko disclosed all the elements in the proposed claims, but did not cite to any specific disclosure of Velichko. Instead, the Examiner simply repeated the language of the claim. Opp. Ex. K at SIONYX1403000031.0042–0046. Nothing in the record establishes that the Examiner understood that claim 1 required that the light must bounce back into the pixel twice and rejected the claim as anticipated by Velichko on this ground. As such, there is not clear evidence that the Examiner relied on the language "back into the pixel back into the pixel" in the rejection.

Finally, during the *Markman* hearing, Samsung's counsel stated that "[t]he limitation can reasonably be construed to require that light bounced back into the pixel twice. And this alone would preclude the Court from modifying the claim language." Tr. at 88:21-24. Whether or not a correction is reasonable examines whether *the correction itself* should be adopted (over potential alternative corrections). *See Pavo Solutions*, 35 F.4th at 1376. Thus, in *Pavo Solutions*, the court analyzed whether the existence of an alternative correction meant that there was a reasonable debate as to what the construction should be. *Id.* at 1376-1377. In deciding the initial inquiry –

whether the claim language contained an obvious minor typographical or clerical error – the Federal Circuit has not stated that a term lacks an obvious error so long as there is some reasonable way in which to interpret the claim language. Further, as noted above, it is not reasonable to find that the patentee indicated an intent for an action to occur twice by repeating a phrase. There is not a language convention that indicates it is appropriate to convey a requirement for an action to occur twice by repeating the words twice.

For all of the above reasons, I find that the inclusion of "back into the pixel back into the pixel" was a typographical error.

I next find that the correction to resolve this error is not subject to reasonable debate. In its initial brief, SiOnyx asserts that the second "back into the pixel" should simply be deleted.[9] Samsung does not proffer an alternative correction. Accordingly, I find that the correction is not subject to reasonable debate based on consideration of the claim language and the specification. The proper correction would be to construe the phrase as "thereupon from inside the pixel back into the pixel."

Finally, I find that the prosecution history does not suggest a different interpretation of the claims. As explained above, the prosecution history does not clearly address this issue and therefore cannot be used as evidence that there is an alternative correction to simply deleting the second "back into the pixel."

For the above reasons, in this Investigation, the term "thereupon from inside the pixel back into the pixel back into the pixel" will be amended to read "thereupon from inside the pixel back into the pixel."

[9] After the *Markman* hearing, SiOnyx changed its proposed construction to the one set forth above. This appears to be an attempt at a compromise. *See* Tr. at 93:25-94:11. It is not, however, a correction to the claim language, which is the issue presented here.

6. "imager device"

The term "imager device" appears in claims 1, 18, and 54, 55, 60, 61, 64, 68, 69, 70, 74, 75, 80, and 82 of the '359 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
device with multiple pixels arranged to capture an image	Preamble is not limiting

JC at 3.

SiOnyx asserts that the examiner found that the preamble is "necessary to give life, meaning, and vitality to the claimed invention." CMIB at 18 (quoting *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999)). SiOnyx explains that the term "imager device" was added to the preamble during prosecution to overcome a rejection of the claim based on prior art. *Id.* at 18-19. SiOnyx also asserts that "the structure of the issued claims shows that the preamble should be construed to be limiting." *Id.* at 19.

Samsung argues that "[t]he bodies of the independent claims . . . define structurally complete alleged inventions, and the preamble ('imager device') provides only a purpose or intended use of the alleged inventions." RMIB at 27. Samsung states that "the absence of 'imager device' would not affect the structural definition or operation of the alleged inventions, particularly considering the specificity of the structure recited in the claim limitations." *Id.* Samsung further argues that there is not "any basis for applying any exceptions to the general rule that a preamble is not limiting." *Id.* It explains that "the preambles do not supply an antecedent basis," nor do they "recite any . . . transitional phrase." *Id.*

The Federal Circuit has explained that "as a general rule preamble language is not treated as limiting." *Artic Cat Inc. v. GEP Power Prods. Inc.*, 919 F.3d 1320, 1327 (Fed. Cir. 2019). A

preamble is limiting "if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim." *Id.* A preamble is not limiting, however, "where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention." *Id.* at 1328 (internal quotations and citations omitted).

Here, the body of the claims recite a structurally complete invention. For example, claim 1 of the '359 patent recites "at least two adjacent light sensitive image sensor pixels" further comprising specific surfaces and having at least one doped region on at least one of the surfaces and a "peripheral isolation element" having at least three layers. Accordingly, Federal Circuit guidance indicates the preamble is not limiting. *Intirtool, Ltd. v. Texar Corp.*, 369 F.3d 1289, 1295 (Fed. Cir. 2004) ("If the body of the claim describes a structurally complete invention such that deletion of the preamble phrase does not affect the structure or steps of the claimed invention, the preamble is generally not limiting unless there is clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art." (internal quotations omitted)).

SiOnyx argues that the preamble was relied on during prosecution to distinguish the claimed invention from the prior art. CMIB at 18. I disagree. The preamble of the originally filed claims recited a "light trapping device." Mot. Ex. 9 at *.0004. The Examiner rejected these claims due to Velichko. *Id.* at *.3529. The patentee amended the claims, but kept the preamble the same. *Id.* at *.3567. The Examiner then rejected the amended claims due to Haddad. *Id.* at *.4036. The patentee amended the claims again and, in doing so, changed the preamble from "[a] light trapping device," to "[a]n imager." *Id.* at *.4074. The Examiner once again rejected the claims as obvious pursuant to Haddad. *Id.* at *.4171. The patentee again amended the claims to add the words "image sensor" before pixel and to further add an additional claim limitation. *Id.* at *.4213. The patentee

noted that "image sensor" was added "in order to further clarify that claim 34 is directed to an imager device." *Id.* at *.4211. The Examiner allowed the claims.

According to SiOnyx, the examiner rejected the initial claims due to Velichko and Haddad because each reference "teaches a light trapping device" and the patentee amended the preamble to an "imager device" to overcome these rejections. CIMB at 19. The Examiner did not specifically mention the preamble in either the rejections due to Velichko or Haddad. Rather, the Examiner recited the claim language and stated his conclusion that the references teach these limitations. *Id.* at *.3529-.3530; *.4036-.4037. Nor did the patentee specifically indicate why it was changing the language of the preamble. Thus, I do not find that this history is indicative of a clear statement that the preamble is "necessary to give life, meaning, and vitality" to the claimed inventions.

Nor do I find that the patentee's statement about the preamble shows a "clear reliance" on the preamble to distinguish the claimed invention. Although the patentee noted that it was amending the claim to clarify that it was "directed to an imager device," the patentee also acknowledged that Haddad "is generally directed to a photosensitive imager device." Opp. Ex. S at *.0040. It therefore does not appear that the patentee specifically amended the preamble to overcome Haddad. Further, even if this history can be read as supportive of the idea that the patentee relied on the preamble, it is not *clear* evidence of a reliance on the preamble to distinguish the claimed invention from the prior art. *See Intirtool*, 369 F.3d at 1295 (explaining that there must be "clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art"). As such, I do not find it sufficient to overcome the general understanding that the preamble is not limiting.

For the above reasons, in this Investigation, the term "imager device" shall not be construed as limiting.

7. "A photosensitive imager device capable of detecting visible and infrared electromagnetic radiation"

The term "a photosensitive imager device capable of detecting visible and infrared electromagnetic radiation" appears in claims 1 and 32 of the '737 patent. Although claims 1 and 32 are not asserted in this investigation, SiOnyx asserts claims that depend on claims 1 and 32. Thus, this term still needs to be construed. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
Plain and ordinary meaning.	Preamble is limiting and means, "An image sensor pixel capable of detecting visible and infrared electromagnetic radiation"

JC at 3.

The parties agree that the preamble is limiting. CMIB at 20; RMIB at 28. SiOnyx asserts that Samsung's proposal to redefine "photosensitive imager device" to a single "image sensor pixel" should be rejected. CMIB at 20. According to SiOnyx, "[t]he specification never equates 'imager' with a single 'pixel,' and instead "expressly treats the two terms separately." *Id.* SiOnyx therefore contends that the plain and ordinary meaning of the term should apply. *Id.* at 21. To the extent the term needs to be further defined, SiOnyx asserts that the "inclusion of 'and/or' is necessary to give meaning to the original claim term, which requires only that the device be 'capable of detecting visible and infrared electromagnetic radiation." *Id.* Thus, "an image captured by the imager does not need to include both categories of electromagnetic radiation." *Id.*

Samsung argues that the claim requires a "photosensitive imager device capable of detecting visible **and** infrared electromagnetic radiation." RMIB at 29. Samsung asserts that "[t]he conjunctive word 'and' has a clear and well-understood meaning – that, is the photosensitive imager device must be capable of detecting **both** visible and electromagnetic radiation." *Id.*

(emphasis in original). Samsung notes that "[n]othing in the specification supports" a reading of including the words "and/or." *Id.* Samsung also argues that "the claims and the specification make clear that 'photosensitive imager device' should be construed as 'an image sensor pixel,' as opposed to multiple pixels." *Id.* at 30.

There are two disputes between the parties with respect to this term. The first dispute is whether "photosensitive imager device" is limited to one pixel. I start with the understanding that "the words of a claim are generally given their ordinary and customary meaning." *Phillips*, 415 F.3d at 1312-1313. SiOnyx asserts that "photosensitive imager device" has a plain and ordinary meaning and that such a meaning does not require limiting the term to a single image sensor pixel. In support of its argument, it submitted a declaration from Dr. Foty, who stated that "[t]his term is readily understandable, particularly to a POSITA" and "accordingly, no construction is required." CMIB Ex. 6 at ¶ 53.

Samsung does not specifically argue that the term "photosensitive imager device" lacks a plain and ordinary meaning to one of skill in the art. *See* RMIB at 28-31. Instead, Samsung argues that "the claims and the specification make clear that 'photosensitive imager device' should be construed as 'an image sensor pixel,' as opposed to multiple pixels." *Id.* at 30. Samsung does not, however, point to anything in the intrinsic record that clearly equates a "photosensitive imager device" with an "image sensor pixel." Instead, Samsung asserts that one can infer that a photosensitive imager device must be limited in this manner due to certain limitations in dependent claims and a passage in Alie (which is incorporated by reference).

First, Samsung explains that "claims 7 and 38, which depend from claims 1 and 32, require "[t]he device of claim [1/32], further comprising deep trench isolation for isolating the device." RMIB at 30. Samsung then states that "[d]eep trench isolation features are used to isolate

individual pixels, as opposed to the broader sensor device." *Id.* As such, Samsung asserts that these dependent claims demonstrate that a photosensitive imager device must be limited to a single pixel. *Id.* Samsung's argument is too tenuous to support such a finding. For Samsung's argument to prevail, I must first assume that Samsung is correct that isolation features necessary indicate that the device is a single pixel. Samsung does not cite to any evidence to support this statement, however, and relies entirely on attorney argument.[10] *See* RMIB at 30. Additionally, even assuming Samsung were correct, a reference to isolation in the dependent claims would simply mean that, to meet the limitations of a dependent claim, the photosensitive imager device would be an image sensor pixel. It would not foreclose the possibility that a photosensitive imager device of the independent claim can be something broader. Thus, I am not persuaded that the dependent claims demonstrate a clear intent of the patentee to limit a photosensitive imager device to a single pixel.

Next, Samsung argues that Alie "depicts in Figure 7 'an array of photodetectors 72.'" RMIB at 30 (quoting RMIB Ex. A at ¶ [0097]). Samsung states: "These 'photodetectors are separated by a plurality of isolation features, in this case extending through the semiconductor layer 34 and the textured region 36." *Id.* According to Samsung, this discussion "clarifies that the claimed 'deep trench isolation for isolating the device' is used to isolate the individual 'photodetectors,' or pixels – which confirms that the claimed 'imager device' in the '737 patent is limited to a single pixel." *Id.* This argument suffers from the same problem as above. I find that it does not provide clear support that the patentee intended to limit a "photosensitive imager device" to an "image sensor pixel."

[10] I note that SiOnyx disagrees with this statement. SiOnyx states that "the purpose of 'isolation' is to prevent cross-talk between neighboring pixels." CMRB at 13.

Additionally, there is evidence in the intrinsic record that supports SiOnyx's understanding of the claim scope. The patent specification refers to imagers and pixels as distinct from each other. For example, it states:

> Generally, and without limitation, the present disclosure provides a variety of optoelectronic devices, such as, broadband photosensitive diodes, pixels, and imagers capable of detecting visible as well as infrared electromagnetic radiation, including associated methods of making such devices.

'737 patent at 6:12-16. While this language does not explicitly use the word "device" after imager, it does indicate that imagers are a type of device. It therefore supports the view that an imager device is something different than a pixel. Accordingly, I reject Samsung's construction and find that "photosensitive imager device" should be given its plain and ordinary meaning.

The second dispute is whether it is appropriate to include the words "and/or" in the phrase "capable of detecting visible [and/or] infrared electromagnetic radiation." The Federal Circuit has explained that "and" should be given its plain and ordinary meaning unless the intrinsic evidence compels a disjunctive construction. *Medgraph Inc. v. Medtronic*, 843 F.3d 942, 949-950 (Fed. Cir. 2016) ("Because the written description does not compel a disjunctive construction for 'and,' the claim term should be given its plain and ordinary meaning."). Here, SiOnyx has not pointed to anything in the intrinsic record that indicates that the photosensitive imager device must be capable of detecting either visible electromagnetic radiation <u>or</u> infrared electromagnetic radiation. SiOnyx itself acknowledges that "the device needs to be capable of absorbing both visible and infrared electromagnetic radiation." CMIB at 21. The specification likewise specifies that the invention must be capable of detecting both. '737 patent at 6:12-16 ("[T]he present disclosure provides a variety of optoelectronic devices . . . capable of detecting visible as well as infrared electromagnetic radiation."). Finally, Dr. Foty conceded that "the image sensor has to be capable of detecting both visible and infrared as it's written here." RMIB Ex. I at 133:2-5. Thus, it is not

appropriate to include an "and/or" in this phrase.[11] Instead, the phrase "and" should be given its plain and ordinary meaning.

For the above reasons, in this Investigation, the term "a photosensitive imager device capable of detecting visible and infrared electromagnetic radiation" will be construed as having its plain and ordinary meaning.

8. "the textured layer"

The term "the textured layer" appears in claim 6 of the '737 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
textured region	Indefinite

JC at 4.

SiOnyx asserts that its construction "corrects a typographical error and provides proper antecedent basis." CMIB at 22. SiOnyx explains that "[t]he term 'the textured layer' appears only twice, in dependent claims 6 and 37."[12] *Id.* It further explains that "[b]oth claims depend from earlier claims introducing a limitation to the 'textured region' from independent claims 1 and 32." *Id.* Claims 6 and 37 then "add that the device 'further compris[es] a reflector layer disposed between the textured layer and the support substrate." *Id.* Thus, "[a] POSITA would understand based on the claim dependency that the 'reflector layer' is the intended addition of the dependent

[11] In its reply brief, SiOnyx states that "[t]he 'and/or' is appropriate because the device need only be 'capable of detecting' visible and infrared light, but need not produce an image including both." CMRB at 14. Samsung does not suggest that "capable" should be construed as anything other than having its plain and ordinary meaning. Thus, there is no need to include the word "or" to address SiOnyx's concern. Rather, including an "or" would capture a device that is capable of only detecting visible electromagnetic radiation, but not infrared electromagnetic radiation (or vice versa).

[12] Claim 37 is no longer asserted in this investigation. Order 31 at 2 (December 10, 2024).

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claims and that the 'textured layer' refers to the 'textured region' as recited in all other claims." *Id.* SiOnyx also argues that this understanding is consistent with the specification. *Id.* Finally, SiOnyx asserts that "[a] claim term that lacks antecedent basis does not render the claim indefinite if 'the scope of a claim would be reasonably ascertainable by those skilled in the art.'" *Id.* at 23 (quoting *Energizer Holding, Inc. v. ITC*, 435 F.3d 1366, 1370-71 (Fed. Cir. 2006)).

Samsung argues that the location of the "reflector layer" of claims 6 and 37 "is dependent upon the location of the 'textured layer," but "the term 'textured layer' lacks antecedent basis." RMIB at 32. Samsung disagrees that the inclusion of "textured layer" is a typographical error. *Id.* Samsung notes that "Dr. Foty has not identified any evidence that the inclusion of 'textured layer' is a typographical error beyond the fact that this term lacks an antecedent basis." *Id.* Samsung also notes that '[t]his claim terms fails to satisfy at least the first requirement for correction as a typographical error – *i.e.*, the requirement that the alleged correction is not subject to reasonable debate based on consideration of the claim language and specification." *Id.* at 33.

As noted above, a district court can only correct an error in a patent if: "(1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the prosecution history does not suggest a different interpretation of the claims." *Novo Indus.*, 350 F.3d at 1354. Even if I agreed with SiOnyx that "the textured layer" was a typographical error, I find that I cannot correct the language because the correction would be subject to reasonable debate. SiOnyx asserts that the proper way to correct the purported error would be to change the language "the textured layer" to "the textured region." As Samsung notes, however, an alternative correction would be to change "*the* textured layer" to "*a* textured layer."

Tr. at 125:28; *see also* RMIB at 33. Doing so would remove any concern about a lack of antecedent basis.[13]

Nor do I find that both corrections would result in the same claim scope based on an alleged interchangeable use of the terms. The patent specification does not provide that "textured layer" and "textured region" are, in fact, interchangeable. The patent specifically defines "textured layer." '737 patent at 4:4-28. While the patent indicates that "the terms 'textured layer' and 'textured surface' can be used interchangeably," it does not identify "textured region" as a synonymous term. *Id.* Additionally, the portion of the specification that discusses the reflector layer refers to a textured layer, as opposed to a textured region:

> As has been described, a light reflector layer can additionally be disposed between any two of the above referenced layers or materials. For example, in one aspect a reflector layer can be applied to one side of the textured layer. In another aspect, a reflector layer can be applied to either side of a bonding layer. In one specific aspect, a reflector layer can be positioned between a first and second bonding layer.

Id. at 8:52-59. Finally, the specification explains that a textured region can be formed directly as part of the semiconductor layer, *i.e.*, without the use of a separate textured layer. *See id.* at 9:55-59 ("In one aspect, the textured region can be formed directly on the semiconductor layer (e.g. a silicon epi-layer). In another aspect, an additional material can be deposited onto the semiconductor layer to support the formation of the textured layer."). Thus, a "textured layer" and a "textured region" do not appear to be synonymous. As such, it is not apparent that substituting "textured region" for "textured layer" would result in the same scope as substituting "a textured layer" for "the textured layer."

[13] SiOnyx asserts that such a construction would be incorrect because it "contradicts the dependency of the claims wherein the intended addition is the reflective layer." CMRB at 14. SiOnyx does not, however, expand on this argument. Additionally, as noted below, the portion of the specification that discusses the reflective layer refers to a textured layer. It is thus not clear how construing the phrase as "a textured layer" would "contradict[] the dependency of the claims."

Having found that I lack the authority to correct "the textured layer," I must determine whether the lack of antecedent basis renders the claim term indefinite. In 2006, the Federal Circuit explained that a lack of antecedent basis does not necessarily render a claim term indefinite. *Energizer Holdings, Inc. v. Int'l Trade Comm'n*, 435 F.3d 1366, 1370 (Fed. Cir. 2006). In reaching this decision, the court explained that "[t]he requirement of antecedent basis is a rule of patent drafting, administered during patent examination" and noted that the *Manual of Patent Examining Procedure* indicates that "the failure to provide explicit antecedent basis for terms does not always render a claim indefinite." *Id.* (citing MPEP § 2173.05(e) (8th ed. Rev. 2, May 2004).[14] Thus, there is no *per se* rule that a lack of antecedent basis compels a finding of indefiniteness.

Without a *per se* rule, to establish that "the textured layer" is indefinite, Samsung must introduce clear and convincing evidence that "its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. Samsung has not done so. Samsung does not make an argument for why one of skill would fail to understand the scope beyond the fact that there is a lack of antecedent basis. RMIB at 32-34; RMRB at 15-17. As such, it has not met its burden to demonstrate that the term is indefinite.

For the above reasons, I find that the term "the textured layer" is not amenable to correction but is also not indefinite.

[14] *Energizer Holdings* was decided prior to *Nautilus*. In reaching its conclusion, the court noted that "[a] claim that is amenable to construction is not invalid on the ground of indefiniteness." *Id.* While this particular part of *Energizer Holdings* has been overruled, the finding that a lack of antecedent basis does not render a claim term *per se* indefinite still stands. *See Bushnell Hawthorne, LLC v. Cisco Sys.*, 813 Fed. App'x 522 (Fed. Cir. 2020) (nonprecedential opinion stating that "[t]he lack of antecedent basis signals a potential indefiniteness problem but does not end the inquiry.").

9. "substantially"

The term "substantially" appears in claims 12, 24, 43, and 54 of the '737 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

SiOnyx	RESPONDENTS
to the same overall result as if absolute and total completion were obtained	the complete or nearly complete extent or degree of an action, characteristic, properly, state, structure, item, or result so as to have the same overall result as if absolute and total competition were obtained

JC at 4.

SiOnyx asserts that its proposed construction "clarifies the meaning and scope of the term in the same way as SiOnyx's proposed construction of 'substantially' in the" other patents. CMIB at 24. SiOnyx asserts that its "proposal makes more sense considering the surrounding claim language." *Id.*

Samsung states that its previous arguments with respect to "substantially" "apply equally to the '737 patent." RMIB at 35.

For the same reasons as set forth above with respect to "substantially," I find that "substantially" means "the complete or nearly complete extent or degree of an action, characteristic, property, state, structure, item or result." I decline, however, to construe the term in this manner, as each instance of "substantially" will need to have an individual construction tailored to the specific use.

Bryan F. Moore
Administrative Law Judge

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