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Paper No. _____

Date: January 22, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

SIONYX, LLC,
Patent Owner.

Case IPR2024-01430
Patent 11,069,737 B2

PATENT OWNER'S PRELIMINARY RESPONSE

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

TABLE OF CONTENTS

	Page
TABLE OF AUTHORITIES	ii
LIST OF PATENT OWNER’S EXHIBITS	iii
CLAIM LISTING FOR U.S. PATENT NO. 11,069,737	iv
I. INTRODUCTION	1
II. SUMMARY OF ARGUMENTS	2
III. INSTITUTION SHOULD BE DENIED FOR FAILING TO SHOW THAT THERE IS A REASONABLE LIKELIHOOD THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE	3
A. Ground 1: Petitioner Has No Anticipation Position And A POSITA Would Not Have Been Motivated To Modify Alie As Proposed	3
1. Petitioner Cannot Rely on Anticipation.....	4
2. Petitioner’s Obviousness Argument Is Legally Deficient Because It Fails to Make the Required Showing on Motivation.....	6
B. Ground 3: Petitioner’s Combination Of Alie With Jiang Does Not Address The Shortcomings Of Ground 1	10
IV. CONCLUSION.....	10
CERTIFICATE OF COMPLIANCE.....	11
CERTIFICATE OF SERVICE	12

TABLE OF AUTHORITIES

	Page
CASES	
<i>Belden Inc. v. Berk-Tek LLC</i> , 805 F.3d 1064 (Fed. Cir. 2015)	6, 7, 9
<i>Enplas Display Device Corp. v. Seoul Semiconductor Co.</i> , 909 F.3d 398 (Fed. Cir. 2018)	5
<i>Net MoneyIN, Inc. v. Verisign, Inc.</i> , 545 F.3d 1359 (Fed. Cir. 2008)	4
<i>SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.</i> , 225 F.3d 1349 (Fed. Cir. 2000)	7
 CODES, REGULATIONS AND OTHER AUTHORITIES	
35 U.S.C. § 313	1
35 U.S.C. § 314(a)	1
37 C.F.R. § 42.107(a).....	1
37 C.F.R. § 42.107(e).....	2
37 C.F.R. § 42.108(c).....	1

LIST OF PATENT OWNER'S EXHIBITS

PO Exhibit Number	Description
	Filed and Served on October 24, 2024 with Patent Owner's Motion for <i>Pro Hac Vice</i> Admission of Andrew P. Zappia Under 37 C.F.R. § 42.10
2001	Declaration of Andrew P. Zappia in Support of Patent Owner's Motion for <i>Pro Hac Vice</i> Admission
	Filed and Served on January 22, 2025 with Patent Owner's Preliminary Response
2002	Disclaimer in a Patent under 37 C.F.R. § 1.321(a), dated January 22, 2025
2003	Electronic Acknowledgement Receipt for Disclaimer dated January 22, 2025

CLAIM LISTING FOR U.S. PATENT NO. 11,069,737

1. [1Preamble] A photosensitive imager device capable of detecting visible and infrared electromagnetic radiation comprising:
[1a] a semiconductor layer having a light incident side and an opposed side, said semiconductor layer having multiple doped regions forming at least one junction,
[1b] 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,
[1c] a support substrate coupled to said semiconductor layer, and
[1d] 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.
8. The device of claim 7, wherein said deep trench isolation provides light trapping functionality.
9. The device of claim 1, wherein the semiconductor layer is single crystal silicon.
10. The device of claim 1, wherein the semiconductor layer comprises silicon and germanium.
11. The device of claim 1, wherein the surface features are formed in the semiconductor layer.
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.
14. The device of claim 1, wherein said first bonding layer comprises any of silicon oxide, silicon nitride and amorphous silicon.

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.
17. The device of claim 1, wherein said bonding layer has a thickness in a range of about 30 nm to about 3 microns.
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.

23. The device of claim 1, further comprising a second bonding layer positioned between the first bonding layer and the support substrate.

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

25. The device of claim 1, wherein the pattern is a non-uniform arrangement.

26. **[26Preamble]** A method of making a photosensitive image device, comprising:

[26a] 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;

[26b] providing a support substrate;

[26c] bonding the semiconductor layer to the support substrate;

[26d] creating a plurality of surface features on one of the semiconductor layer and the support substrate, wherein the surface features are formed via etching;

[26e] depositing an oxide material within at least a portion of the semiconductor layer or support substrate removed during etching; and

[26f] processing the region of the semiconductor layer or support substrate comprising the surface features with CMP after depositing the oxide material.

27. [27Preamble] The method of claim 26, wherein bonding the semiconductor layer to the support substrate comprises:

[27a] depositing a first bonding layer onto the semiconductor layer; and

[27b] bonding the first bonding layer to a second bonding layer disposed on the support substrate.

28. The method of claim 26, wherein 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.

31. The method of claim 26, wherein the surface features are formed in the semiconductor layer.

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

[32a] a semiconductor layer having a light incident side and an opposed side, said semiconductor layer having multiple doped regions forming at least one junction.

[32b] 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,

[32c] a support substrate coupled to said semiconductor layer, and

[32d] a first bonding layer disposed between the semiconductor layer and the support substrate,

[32e] 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.

34. The device of claim 33, further comprising a device layer coupled to the semiconductor layer on said side opposed to the light incident side.

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.

37. The device of claim 33, further comprising a reflector layer disposed between the textured layer and the support substrate.

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.

40. The device of claim 32, wherein the semiconductor layer is single crystal silicon.

41. The device of claim 32, wherein the semiconductor layer comprises silicon and germanium.

42. The device of claim 32, wherein the surface features are formed in the semiconductor layer.

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.
46. The device of claim 32, wherein said semiconductor layer has a thickness in a range of about 1 micron to about 10 microns.
47. The device of claim 32, wherein said bonding layer has a thickness in a range of about 30 nm to about 3 microns.
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.

53. The device of claim 32, further comprising a second bonding layer positioned between the first bonding layer and the support substrate.

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

55. The device of claim 32, wherein the surface features are arranged according to a pattern that is a non-uniform arrangement.

EX1001 ('737 Patent), 12:66-16:22.

I. INTRODUCTION

Pursuant to 37 C.F.R. § 42.107(a) and 35 U.S.C. § 313, SiOnyx, LLC (“Patent Owner”) submits this Preliminary Response to the Petition for *Inter Partes* Review of claims 1-55 of U.S. Patent No. 11,069,737 (“Petition”) (EX1001) (“the ’737 Patent”) filed by Samsung Electronics Co., Ltd. (“Petitioner”) on September 24, 2024, with a filing date accorded of September 24, 2024 (Paper 7). This Preliminary Response is timely filed.

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

The Petition challenged all claims of the ’737 Patent. Without waiver of any defenses or admission as to any theory of invalidity presented by Petitioner, and solely to narrow the issues presented by the Petition, Patent Owner has disclaimed claims 1, 7-27, 29-32, and 38-55 of the ’737 Patent. *See* EX2002; EX2003. In view of this disclaimer, the U.S. Patent and Trademark Office Patent Trial and Appeal Board (“the Board”) and this Preliminary Response need only address claims 2-6, 28, 33, and 34-37 of the ’737 Patent (the “Challenged Claims”). *See* 37

C.F.R. § 42.107(e) (“[n]o *inter partes* review will be instituted based on disclaimed claims.”).

II. SUMMARY OF ARGUMENTS

Petitioner has failed to meet its burden to show a reasonable likelihood that at least one of the Challenged Claims is unpatentable over Alie.¹ Petitioner has not presented arguments to support anticipation of the Challenged Claims. To support its invalidity theory, Petitioner makes modifications to the Alie reference and relies on this modified version of Alie for its invalidity theory. While Petitioner fails to clearly state its invalidity theory, the fact that Petitioner must modify Alie to make its argument removes anticipation from consideration.

Regarding any obviousness theory, Petitioner fails to present any proofs or arguments for why a person of ordinary skill in the art (“POSITA”) would have been motivated to modify Alie to arrive at the invention of the Challenged Claims. Instead, Petitioner only argues that a POSITA could have modified Alie, which is legally deficient and fatal to the Petition. Therefore, institution should be denied.

¹ To the extent not defined herein, defined terms used herein have the same meaning as ascribed to them in the Petition.

III. INSTITUTION SHOULD BE DENIED FOR FAILING TO SHOW THAT THERE IS A REASONABLE LIKELIHOOD THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE

Petitioner proffers two Grounds for attacking claims 2-6, 28, 33, and 34-37:

Ground	[Petition] Challenged Claims	[Remaining (Not Disclaimed)] Challenged Claims	Basis for Rejection
1	1-11, 13-42, and 44-55	2-6, 28, 33, 34-37	§102 and/or §103: Alie (EX1006)
3	16, 32-42, and 44-55	33, 34-37	§103: Alie (EX1006) and Jiang (EX1008)

See Petition, 4-6; *see also* EX2002, 1; EX2003.

As discussed below, Petitioner has failed to meet its burden to show a reasonable likelihood that at least one of the Challenged Claims is unpatentable under these Grounds. First, Petitioner modifies Alie, so Petitioner cannot assert anticipation. Second, Petitioner has not shown why a POSITA *would have been* motivated to modify Alie to have a textured region or plurality of surface features on the light incident side of the semiconductor layer, elements in all the Challenged Claims.

A. Ground 1: Petitioner Has No Anticipation Position And A POSITA Would Not Have Been Motivated To Modify Alie As Proposed

Petitioner posits that Alie discloses the limitations of claim 2, or “at a minimum, renders [claim 2] obvious.” Petition, 28. Thus, Petitioner appears to be arguing either anticipation or obviousness. However, all its invalidity arguments

for the Challenged Claims depend on modifications to the disclosure of Alie, namely a modified version of Figure 5 of Alie. Petition, 29.

This admission that Alie needs to be modified to support an invalidity theory eliminates Alie as anticipatory art. Further, Petitioner's obviousness theory relies only on an assertion that a POSITA *could* modify the Alie reference. The Petition and its supporting declaration (EX1004) are silent on the critical requirement for showing motivation to combine based on a modification to the prior art: *why* a POSITA would have made the modification. Petitioner's obviousness argument is therefore legally deficient.

Petitioner's arguments concerning claims 28 and 33 rely on and refer to Petitioner's deficient claim 2 argument; consequently, the failure of the claim 2 argument is dispositive on all three claims. *See* Petition, 24-28, 60-61, and 64. The remainder of the Challenged Claims (Claims 3-6, and 34-37) depend from one of claims 2, 28 or 33. As a result, Ground 1 fails.

1. Petitioner Cannot Rely on Anticipation

While Petitioner attempts to cast its position as encompassing both anticipation and obviousness, Petitioner's argument relies on modifications to Alie. Petition, 24-28. As a result, the only invalidity theory presented is obviousness. This is because where modification is required to meet the elements of a claim, the argument "invoke[s] the question of obviousness, not anticipation." *Net MoneyIN*,

Inc. v. Verisign, Inc., 545 F.3d 1359, 1371 (Fed. Cir. 2008); *see also Enplas Display Device Corp. v. Seoul Semiconductor Co.*, 909 F.3d 398, 405 (Fed. Cir. 2018) (“Prior art that must be modified to meet the disputed claim limitation does not anticipate the claim.”).

Despite stating that Alie either “discloses this limitation, or at a minimum, renders this limitation obvious,” Petitioner admits that its argument requires a modification of Alie’s disclosed embodiments. Petition, 24. Specifically, the Petition states “it would have been *obvious to modify the device of Figure 5* by placing the semiconductor substrate 32 and dielectric layer 38 on the top side of the semiconductor layer.” Petition, 26 (emphasis added); *see also* Ex. 1004 (“Lebby Declaration”), ¶99 (same). Since the Petition relies on modifications to Alie to meet the elements of claim 2, Petitioner cannot assert anticipation, and thus has only presented an obviousness argument.²

² Petitioner’s arguments concerning claims 28 and 33 rely on and refer to the argument concerning claim 2; thus, the only invalidity argument asserted against independent claims 28 and 33 are likewise obviousness over Alie. *See* Petition, 60-61, 64.

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

Petitioner's obviousness argument is fatally flawed. Not only is the assertion of obviousness vague – since the source of the modification is unclear – but also Petitioner fails to present any proof that a POSITA would have been motivated to make the proposed modifications to Alie, as required to show obviousness. Without that requisite motivation, Petitioner's obviousness argument fails.

“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (emphasis in original). A Petitioner bears the burden of establishing how and *why* a POSITA would have chosen the cited reference and combine or modify it to arrive at the claimed invention. *See id.*

In the Petition and supporting declaration, Petitioner and its expert only assert that Alie could be modified to achieve the claimed inventions. Petition, 24-28; EX1004, ¶¶95-101. However, Petitioner and its expert do not identify any source of a motivation to make that modification, such as: (i) any knowledge of those skilled in the art; (ii) any specific supporting disclosure in the asserted reference itself; or (iii) the nature of the problem sought to be solved. *See id.* The

Petition is simply silent on why a POSITA would have made this modification.

Instead, Petitioner argues that Alie *could be modified* to meet the elements of claim 2 but Petitioner does not present any position or proof that a POSITA *would have been motivated* to make such a modification. Petition, 24-28. The omission of any motivation for the modification is fatal to Petitioner's arguments.

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

The only two statements in the Petition relevant to Petitioner's modification of Alie fail to address the required showing noted above and are further either unsupported by the factual record or contrary to Alie's teachings. Petitioner's first statement that the proposed modification “allows (1) more incident light to enter via the bottom side of the device, and (2) the semiconductor substrate 32 to provide structural support” is supported only by a cite to the Lebby declaration, which

repeats the statement verbatim. *See* Petition, 27; EX1004, ¶100. This statement nowhere explains why a POSITA would have been motivated to make this modification. Instead, it simply summarizes the purported impact of the modification. This assertion is also indistinguishable from hindsight bias: Petitioner and Dr. Lebby merely repeat the benefits of the claimed invention. A restatement of benefits of the claimed invention cannot establish a motivation to modify the Alie reference.

Petitioner's second statement is that "Alie teaches that absorbing more light leads to an increase in the quantum efficiency." Petition, 27. Alie certainly states this generally, but Petitioner fails to explain why this statement in Alie would have motivated a POSITA to make the modification proposed by Petitioner. Further, reading Alie as a whole shows that it does not support Petitioner's modification.

Alie teaches that the benefit of increased quantum efficiency is achieved through having a pristine light incident surface with texture on the side of the semiconductor layer opposed to the light incident surface. EX1006 (Alie), [0053]. Specifically, Alie states:

"A device design having *a textured region located on, for example, the back surface of a photodetector, provides significant performance benefits*. The textured region can have surface features that can lead to higher recombination of photocarriers for short wavelengths (e.g. in the blue green part of the spectrum) due to the very shallow penetration of those wavelengths into the

detecting volume of the device. *By physically locating the textured on the back surface of the device, a pristine surface is provided for the collection of short wavelengths on the top surface (i.e. the light incident surface), and the longer wavelengths that penetrate deep into or through the detecting region of the semiconductor material are collected by or with the help of the textured region opposite the light incident surface.*”

Id. (emphasis added).

Thus, Alie expressly teaches that the increased quantum efficiency is achieved by the above architecture. However, Petitioner's modification results in the opposite of the above architecture, namely it puts the textured region on the light incident side of the semiconductor layer (in an effort to match claim 2 and its dependents). The only “evidence” provided in support of this motivation to modify Alie is a list of benefits – benefits that Alie teaches are achieved through the opposite architecture as that required by claim 2.

Petitioner's failure to articulate a motivation to modify Alie is fatal. Without the requisite motivation, the Petition is legally deficient. At best, Petitioner's allegations concerning claim 2 amount to an argument that Alie *could be modified*. That is not a sufficient basis to support an obviousness theory. “[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc.*, 805 F.3d at 1073 (emphasis in original).

All of the Challenged Claims ultimately depend from claim 2, or from its analogs, claims 28 and 33, so Ground 2 fails.

B. Ground 3: Petitioner's Combination Of Alie With Jiang Does Not Address The Shortcomings Of Ground 1

Petitioner asserts that the combination of Alie with Jiang renders obvious claims 16, 32-42, and 44-55. All of the Challenged Claims within the scope of Ground 3 ultimately depend from either claim 1 (claim 16) or claim 32 which mirrors claim 1 (claims 33-42 and 44-55), and Ground 3 relies on the same modification to Alie discussed above. *See* Petition, 84. As a result, Ground 3 fails for the same reasons as Ground 1.

In addition, regarding claim 33, Petitioner's analysis does not address that claim.

IV. CONCLUSION

For the reasons set forth above, Petitioner has failed to demonstrate a reasonable likelihood that it would prevail with respect to any of the Challenged Claims. Thus, *inter partes* review of the '737 Patent should be denied.

Respectfully submitted,

Date: January 22, 2025

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Counsel for Patent Owner

CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this preliminary response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains **2,140** words, according to the word-processing system used to prepare this preliminary response, excluding the parts of this preliminary response that are exempted by 37 C.F.R. § 42.24(c) (including the table of contents, a table of authorities, an exhibits list, a listing of facts, a certificate of service or this certificate of word count, or appendix of exhibits).

Date: January 22, 2025

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Counsel for Patent Owner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), this is to certify that on this 22nd day of January, 2025, I caused to be served a true and correct copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE (with EX2002-2003)** by e-mail (as agreed in the Service Information section of the Petition):

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