

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS, CO. LTD.,
Petitioner,

v.

LED WAFER SOLUTIONS, LLC,
Patent Owner.

IPR2021-01506
Patent 8,941,137 B2

Before LYNNE E. PETTIGREW, JEFFREY W. ABRAHAM, and
TERRENCE W. McMILLIN, *Administrative Patent Judges*.

ABRAHAM, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

Samsung Electronics, Co. Ltd. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–4 and 6–11 of U.S. Patent No. 8,941,137 B2 (Ex. 1001, “the ’137 patent”). Paper 1 (“Pet.”). LED Wafer Solutions, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply to the Preliminary Response (Paper 7) and Patent Owner filed a Sur-reply (Paper 8).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2020). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted “unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons set forth below, upon considering the Petition, Preliminary Response, Reply, Sur-Reply, and the evidence of record, we determine the information presented in the Petition fails to establish a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. Accordingly, we deny the Petition, and do not institute an *inter partes* review.

B. Related Proceedings

The parties identify *LED Wafer Solutions LLC v. Samsung Electronics Co., Ltd.*, No. 6:21-cv-292 (W.D. Tex.) (“the District Court litigation”) as a related matter. Pet. 1; Paper 4, 1. Patent Owner further identifies the following related matters in which additional patents owned by Patent

Owner are challenged: IPR2021-01479, IPR2021-01491, IPR2021-01504, IPR2021-01516, IPR2021-01526, and IPR2021-01554. Paper 4, 1–2.

C. The '137 Patent

The '137 patent is titled “Light Emitting Diode Package and Method of Manufacture.” Ex. 1001, code (54). The '137 patent explains that a light emitting diode (LED) is a semiconductor device configured to receive electrical power and output electromagnetic radiation, and that “the output energy or light is determined by the band gap of the semiconductor materials and operating conditions of the LED.” Ex. 1001, 1:19–27. The '137 patent explains that LEDs “compare favorably to other sources of light,” and provide advantages such as energy efficiency and long-lasting designs, but “conventional LED devices can be relatively costly to manufacture by some metrics when compared to other light sources” due to their exacting package requirements. Ex. 1001, 1:28–43. The '137 patent provides an LED device and packaging for the same in which “the LED is manufactured by epitaxial growth or other chemical or physical deposition techniques of a plurality of layers” and has certain layers which “act to promote mechanical, electrical, thermal, or optical characteristics of the device.” Ex. 1001, 1:66–2:4. According to the '137 patent, its device “avoids design problems, including manufacturing complexities, costs and heat dissipation problems found in conventional LED devices.” Ex. 1001, 2:4–6.

Figure 6 of the '137 patent, reproduced below, shows an exemplary LED device. Ex. 1001, 2:56–57, 4:47–48.

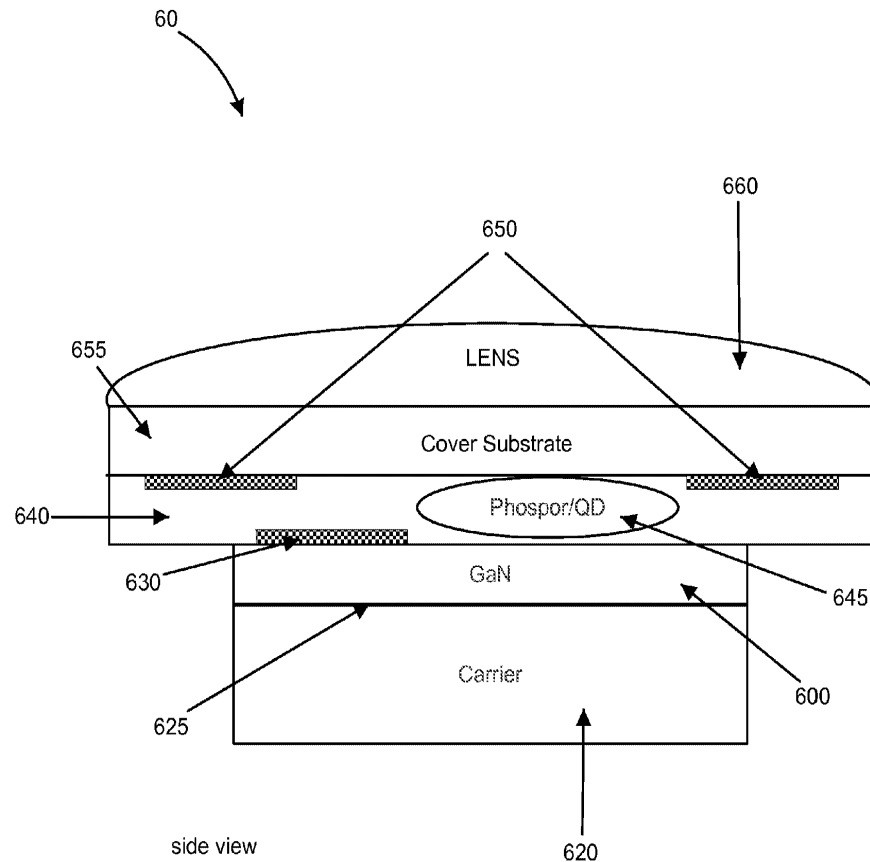


Figure 6 depicts LED device 60 having GaN LED layer 600, carrier layer 620, metallic interface 625, metal pad 630, optically transparent or transmissive adhesive layer 640, region 645 containing phosphor and/or quantum dot material, alignment marks 650, cover substrate 655, and lens 660. Ex. 1001, 4:47–5:17. The '137 patent explains “[i]n operation, photons emitted from LED layer 600 travel through said optically transparent adhesive layer 640 and the region containing the phosphor and/or quantum dots 645. This causes color (wavelength) control and emission of selective desired light out of the LED device.” Ex. 1001, 5:3–8. The '137 patent further explains that cover substrate 655 provides “structural presence and mechanical coupling for elements of the LED device 60,” and

optical lens 660 “can act to spread, diffuse, collimate, or otherwise redirect and form the output of the LED.” Ex. 1001, 5:9–22.

D. Challenged Claims

Petitioner challenges claims 1–4 and 6–11 of the ’137 patent. *See* Pet. 2–3. Of the challenged claims, claim 1 is an independent apparatus claim and claim 9 is an independent method claim. Ex. 1001, 8:15–36, 8:62–9:27. Claim 1 recites:

1. A light emitting device, comprising:
 - a semiconductor LED including doped and intrinsic regions thereof;
 - a conducting support layer disposed proximal to a first surface of said semiconductor LED and separated therefrom by a metallic interface with no additional intervening layers, said conducting support layer is no more than 50 microns in thickness;
 - an optically permissive layer proximal to a second surface of said semiconductor LED, said first and second surfaces of said semiconductor LED being on opposing faces thereof;
 - an optically definable material proximal to or within said optically permissive layer that affects an optical characteristic of emitted light passing therethrough;
 - an optically permissive flat cover substrate covering at least a portion of the above components; and
 - a metal pad between said semiconductor LED and said optically permissive layer,
- wherein, said first surface of said semiconductor LED, said metallic interface and said conducting support layer are all electrically coupled to one another.

Ex. 1001, 8:15–36.

Claim 9 recites:

9. A method for making a light emitting device, the method comprising:

growing a plurality of doped layers in a light emitting device (LED) on a substrate;

depositing a metallic interface onto said LED opposite to said substrate;

electroplating a conductive support layer onto said metallic interface;

lifting off said substrate from said LED;

forming a metal pad on the newly exposed LED surface;

etching a recess through said conductive support layer, said metallic interface and said LED so as to allow electrical contact with said metal pad and consequently a first doped layer of said LED;

providing electrical contact to said conductive support layer and consequently to a second doped layer of said LED so as to bias the LED using a bias voltage applied between said first and second doped layers of the LED; and

securing the LED to an optically permissive cover substrate using an optically permissive layer including an optically definable material through which light generated by said LED can pass.

Ex. 1001, 8:62–9:17.

E. The Asserted Grounds

Petitioner challenges claims 1–4 and 6–11 of the '137 patent based on the grounds set forth in the table below.

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 7, 8	103(a) ¹	Keller, ² Chakraborty ³
1–3, 7, 8	103(a)	Keller, Wirth ⁴
4	103(a)	Keller, Wirth, Tanimoto ⁵
6	103(a)	Keller, Wirth, Tanaka ⁶
9, 10	103(a)	Wirth, Applicant Admitted Prior Art (AAPA), Keller
11	103(a)	Wirth, AAPA, Keller, Tanaka

Pet. 2–3. Petitioner supports its showing of unpatentability of the challenged claims of the '137 patent with the Declaration of Jacob Baker, Ph.D. (Ex. 1002).

II. ANALYSIS

A. Claim Construction

Petitioner “believes that no express constructions of any claim terms are necessary to assess whether the prior art reads on the challenged claims.” Pet. 8 (citing Ex. 1002 ¶ 34). Patent Owner “requests that the Board adopt the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art.” Prelim. Resp. 11.

We determine that no terms require express construction for purposes of determining whether to institute a trial. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017)

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. § 103 effective March 16, 2013. Because the challenged patent claims priority to applications filed before March 16, 2013, we refer to the pre-AIA version of § 103. Our opinions on the present record would not change if the AIA version of § 103 were to apply.

² US 9,634,191 B2, issued Apr. 25, 2017 (Ex. 1005).

³ US 9,287,469 B2, issued Mar. 15, 2016 (Ex. 1006).

⁴ US 8,835,937 B2, issued Sep. 16, 2014 (Ex. 1007).

⁵ US 2009/0001869 A1, published Jan. 1, 2009 (Ex. 1008).

⁶ US 2008/0031295 A1, published Feb. 7, 2008 (Ex. 1009).

(“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

B. Legal Standards

A patent claim is unpatentable as obvious if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when presented, objective evidence of non-obviousness.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

With regard to combining the teachings of multiple references, an articulated reason with some rational underpinning to combine the known elements in the fashion claimed must be provided to support a conclusion of obviousness. *See KSR*, 550 U.S. 418; *see also In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (It is the petitioner’s “burden to demonstrate both that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.”) (citation and internal quotation omitted).

⁷ The parties have not asserted or otherwise directed our attention to any objective evidence of nonobviousness.

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Petitioners cannot satisfy their burden of proving obviousness by employing “mere conclusory statements.” *Magnum Oil*, 829 F.3d at 1380.

C. Level of Ordinary Skill in the Art

With regard to the level of ordinary skill in the art, Petitioner contends that “[a] person of ordinary skill in the art as of the claimed priority date of the ’137 patent . . . would have had a bachelor’s degree in electrical engineering, material science, or the equivalent, and two or more years of experience with light emitting diodes (LEDs).” Pet. 4 (citing Ex. 1002 ¶¶ 18–20). Patent Owner states that “[b]ecause the proposed level of ordinary skill does not affect the ultimate analysis, Patent Owner takes no position with respect to Petitioner’s proposed level of ordinary skill in the art.” Prelim. Resp. 35.

Petitioner’s undisputed proposal is consistent with the technology described in the Specification of the ’137 patent and the cited prior art. In order to determine whether Petitioner has demonstrated a reasonable likelihood of showing the unpatentability of at least one of the challenged claims, we adopt Petitioner’s proposed level of skill in the art.

D. Alleged Obviousness based on Keller in view of Chakraborty or Wirth

Petitioner contends that claims 1, 7, and 8 are unpatentable as obvious over the combined teachings of Keller and Chakraborty, and that claims 1–4 and 5–8 are unpatentable over the combined teachings of Keller and Wirth,

either alone or in view of Tanimoto and Tanaka. Pet. 2–3, 9–52. Patent Owner challenges Petitioner’s assertions. Prelim. Resp. 35–60.

1. Keller (Ex. 1005)

Keller relates to light emitting devices “capable of wire bond free fabrication and operation.” Ex. 1005, 1:10–12. According to Keller, conventional LED packages suffer from various constraints, including the need to connect the device to an outside voltage source using a wire bond. Ex. 1005, 4:1–8. To overcome these constraints, Keller discloses a “new semiconductor device, such as an LED chip, that has two bottom-side electrical contacts, allowing for wire bond free fabrication.” Ex. 1005, 4:15–18.

One embodiment of Keller’s device comprises an active region interposed between an n-type semiconductor layer and a p-type semiconductor layer, with a p-electrode electrically connected to the p-type layer, and an n-electrode connected to the n-type layer. Ex. 1005, 4:18–28. Keller explains that the p- and n-electrodes are “disposed such that a lead is accessible from a point on the surface of the device opposite the primary emission surface.” Ex. 1005, 4:21–27.

Keller depicts an embodiment of its device in Figure 5, reproduced below.

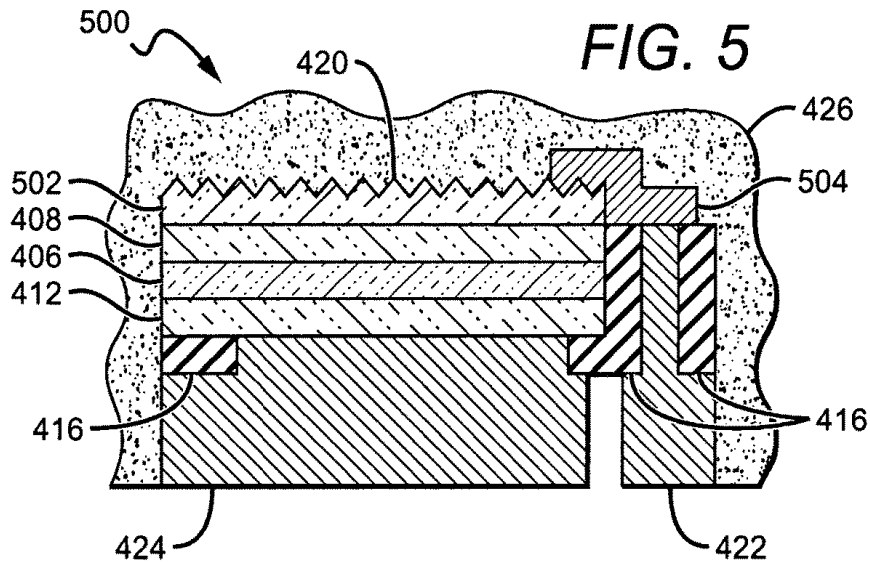


Figure 5 is a cross-sectional view of a semiconductor device, having active region 408 disposed between n-type layer 502 and p-type layer 406, wherein the edges of layers 406, 408, and 502 are all flush with each other. Ex. 1005, 5:33–35, 8:35, 10:64–11:4. Figure 5 also shows n-electrode 422 and p-electrode 424. Ex. 1005, 11:5–10. Keller explains that “[b]ecause all of the semiconductor layers 502, 406, 408 are located entirely above the p-electrode 424, the configuration may exhibit increased structural stability.” Ex. 1005, 11:9–11.

2. Analysis

Independent claim 1 of the ’137 patent recites, *inter alia*, “a semiconductor LED including doped and intrinsic regions thereof.” Ex. 1001, 8:16–17. Referring to Keller Figure 5, Petitioner contends that Keller discloses this limitation because it describes a semiconductor device that has a p-type layer 406 and an n-type layer 502, with an active region 408 disposed between them. Pet. 10–11 (citing Ex. 1005, 7:42–48, Fig. 5), 27 (repeating that Keller discloses or suggests this limitation for its challenge

based on the combination of Keller and Wirth and referring to the earlier analysis in the Petition). Petitioner contends a person of ordinary skill in the art would have understood that the n-type layer and p-type layer are doped regions because Keller discloses that the layers are “oppositely doped.” Pet. 11 (citing Ex. 1005, 7:42–48, 11:1–7). Petitioner also contends that a person of ordinary skill in the art “would have understood that the active region 408 is an ‘intrinsic region’ for several reasons.” Pet. 11 (citing Ex. 1002 ¶¶ 63–67).

First, Petitioner argues that “the lack of any indication of doping (n-type or p-type) of active region 408 (unlike n-type layer 502 and p-type layer 406) suggests that active region 408 is ‘intrinsic’ (i.e., not doped).” Pet. 11. Second, Petitioner argues that during prosecution, the Applicant indicated that “an intrinsic region, when present is ‘typically [provided] between p-n layers,’” and Petitioner notes that, consistent with this statement, Keller’s active region is between p and n layers. Pet. 12 (quoting Ex. 1004, 227). Next, Petitioner contends that Keller explains that light is emitted from the active region interposed between the n- and p-type region due to the radiative combination of electrons and holes in the active region, which is the same light emission mechanism the ’137 patent describes as occurring in the “intrinsic region.” Pet. 12 (citing Ex. 1001, 4:10–21). Finally, Petitioner argues that Keller discloses some embodiments that include a Gallium Nitride (GaN) LED. In view of this, Petitioner asserts

The ’137 patent admits that prior art GaN LEDs “*comprise a P-I-N junction device having an intrinsic (I) layer disposed between a N-type doped layer and a P-type doped layer.*” (Ex. 1001, 3:23-26 (emphasis added); *see also id.*, 4:12-16; Ex. 1002 ¶¶66-67.). Thus, to the extent not explicitly disclosed in Keller, a POSITA would have understood and found it obvious to use an “intrinsic” region for the active region 408 in Keller’s GaN LED

as that is a well-known conventional structure, as admitted by the '137 patent. (Ex. 1002 ¶¶68-69.) Indeed, using an “intrinsic” region for the active region 408 in Keller’s GaN LED would have been obvious because it would have constituted applying a known feature (an intrinsic region provided between n and p-doped layers in a GaN LED) to a particular device (the Keller GaN LED) to achieve a predictable result (emission of light by radiative recombination of a hole and an electron in the intrinsic region). (*Id.* ¶69); *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416-18 (2007).

Pet. 12–13.

Patent Owner argues that Petitioner failed to meet its burden of establishing Keller discloses a semiconductor LED including doped and intrinsic regions. Prelim. Resp. 35–40. Patent Owner contends that Keller does not specify whether the active region 408 is doped or not doped, does not mention “intrinsic” or “PIN” type structures, and does not disclose any structure that suggests or requires a PIN junction device having an intrinsic layer between an n-type doped layer and a p-type doped layer. Prelim. Resp. 36–37.

Patent Owner further contends that “Petitioner’s allegation that the applicant argued during prosecution that an intrinsic region, when present ‘is typically [provided] between p-n layers’ is misleading.” Prelim. Resp. 37. Patent Owner explains that the Applicant’s statement was directed to PIN devices, and reiterates that Keller does not state that its device is a PIN device. Prelim. Resp. 37–38.

Additionally, Patent Owner criticizes Petitioner’s argument comparing the light emission mechanism in Keller and the '137 patent because “the passage cited in the '137 Patent explicitly refers to recombination in a PIN junction device,” whereas “Keller never says that its device is a ‘PIN device.’” Prelim. Resp. 38–39. Furthermore, Patent Owner

notes that Petitioner does not assert that the described combination of charge carriers and holes in the active region “only occurs when the active region is intrinsic.” Prelim Resp. 39.

With regard to Petitioner’s arguments based on Keller’s disclosure of LED devices made using GaN, Patent Owner asserts that the ’137 patent simply states that *some* LEDs are made using GaN and comprise a PIN junction, not that all LEDs made using GaN include an intrinsic layer between the n-doped and p-doped layers. Prelim. Resp. 39. Patent Owner further asserts that Petitioner does not show that LEDs made of GaN inherently require an intrinsic region. Prelim. Resp. 39–40.

Finally, Patent Owner argues that even if a person of ordinary skill in the art would have been aware that LED devices could have been made with an intrinsic layer, Petitioner provides no evidence as to why a person of ordinary skill in the art would have included such a layer in Keller’s devices. Prelim. Resp. 40.

After considering the parties’ arguments and evidence, we agree with Patent Owner that Petitioner has failed to demonstrate sufficiently that Keller discloses or suggests an LED semiconductor having an intrinsic region.

Petitioner identifies, and we discern, no teaching in Keller that active region 408 is an intrinsic region or is undoped or not doped. Nor does Petitioner identify or direct us to any portion of Keller disclosing or suggesting its device has a “PIN” type structure. Instead, Petitioner concedes that there is a “lack of any indication of doping of active region 408,” unlike n-type layer 502 and p-type layer 406. Pet. 11. Contrary to Petitioner’s argument, Keller’s silence with regard to its active layer does not affirmatively suggest the active region is intrinsic, i.e., not doped.

With regard to Petitioner's argument (Pet. 11) based on the statement made during prosecution that an intrinsic region, when present, "is typically [provided] between p-n layers," we agree with Patent Owner that this statement was made in reference to PIN devices. Ex. 1004, 227 ("Applicant's attention is directed toward paragraph 53 [of the asserted prior art reference] for disclosure of an intrinsic region, which is typically between p-n layers (*hence, PIN devices*).") (emphasis added). As noted above, Petitioner has not directed us to any disclosure in Keller suggesting its device is a PIN device. Thus, we fail to see how this statement pertains to what a person of ordinary skill in the art would have understood based on Keller's disclosure. Furthermore, even giving Petitioner the full weight of its argument, the prosecution statement at best indicates where an intrinsic region *would be located* (between p and n layers) *if* one is present. We do not consider the statement to suggest that *any region* located between p- and n-type layers is an intrinsic region. Nor has Petitioner directed us to any evidence supporting such a determination. As a result, we are not persuaded by Petitioner's argument that the prosecution statement demonstrates a person of ordinary skill in the art would have understood Keller to suggest that its active region is an intrinsic region.

Nor are we persuaded by Petitioner's argument that Keller discloses or suggests an active region that is an intrinsic region based on a comparison of the light emission mechanisms in Keller and the '137 patent. Pet. 12. As Patent Owner points out, the '137 patent expressly refers to a PIN junction device, whereas Keller does not. Prelim. Resp. 39. Furthermore, Petitioner effectively asserts that *any time* light is emitted from an active region interposed between n- and p-type regions due to the radiative combination of electrons and holes in the active region, *the active region is an intrinsic*

region. Petitioner, however, does not present evidence sufficient to support such a conclusion. For example, Petitioner does not provide any evidence demonstrating that a person of ordinary skill in the art would have understood that an active region interposed between n- and p-type regions that is doped would not emit light by the same light emission mechanism disclosed in Keller or the '137 patent. *See* Prelim. Resp. 38–39.

Petitioner's arguments based on the disclosure of GaN LEDs having an intrinsic layer in the '137 patent are likewise unpersuasive. *See* Pet. 39–40. The '137 patent explains that some LEDs are made using GaN and are “typically epitaxially grown on a sapphire substrate.” Ex. 1001, 3:22–23. The '137 patent also explains that “these LEDs comprise a P-I-N junction having an intrinsic (I) layer.” Ex. 1001, 3:23–25. On its face, this language indicates that GaN LEDs epitaxially grown on a sapphire substrate comprise a P-I-N junction having an intrinsic layer. We agree with Patent Owner that this discussion of GaN LEDs in the background of the '137 patent does not constitute an admission that *all LEDs made using GaN* include an intrinsic layer between the n-doped and p-doped layers, which appears to be Petitioner's contention. Ex. 1001, 3:19–26; *see* Pet. 12 (“The '137 patent admits that prior art GaN LEDs ‘*comprise a P-I-N junction device having an intrinsic (I) layer* disposed between a N-type doped layer and a P-type doped layer.’”) (emphasis added by Petitioner). Petitioner also cites to column 4, lines 12–16, of the '137 patent to support its assertion, but this portion of the '137 patent refers only to *one embodiment* of a device that has a GaN layer comprising a P-I-N junction. Ex. 1001, 4:12–16. Petitioner does not present any other evidence sufficient to establish that the '137 patent *admits* that all LEDs made using GaN comprise a P-I-N junction with an intrinsic region.

At best, Petitioner demonstrates that a person of ordinary skill in the art would have known that some GaN LEDs may have an intrinsic region disposed between an n-type and p-type layer, and could have used an intrinsic region as Keller's active region 408. However, "obviousness concerns not only whether a skilled artisan *could have made* but *would have been motivated to make* the . . . modifications of prior art to arrive at the claimed invention." *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). Petitioner fails to identify any specific reason why a person of ordinary skill in the art would have used an intrinsic region for Keller's active region.

Petitioner contends that using an intrinsic region for Keller's active region would have constituted applying a known feature to a particular device to achieve a predictable result. Pet. 13 (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416-18 (2007)). Petitioner's argument, however, is conclusory and lacks adequate support. For example, Petitioner cites to, but does not explain, paragraph 69 of Dr. Baker's declaration in support of this argument. In this paragraph Dr. Baker states that "a skilled person would have recognized that configuring a GaN LED in Keller, which includes an intrinsic (I) layer disposed between a N-type doped layer and a P-type doped layer, is just a basic and conventional structure for such a GaN LED device." Ex. 1002 ¶ 69. The problem with this statement is that it presumes Keller's GaN LED includes an intrinsic layer disposed between an n-type and p-type layer. As discussed above, we disagree with this presumption.

It is Petitioner's burden to provide an articulated reason with some rational underpinning to combine the known elements from the cited art in the fashion claimed in order to support a conclusion of obviousness. *See*

KSR, 550 U.S. 418. In the Petition, there is no adequate explanation as to why a skilled artisan would have chosen to use an intrinsic region as the active region for Keller’s LED.

For all of the foregoing reasons, we determine that Petitioner has failed to demonstrate sufficiently that Keller discloses or suggests a semiconductor LED including doped and intrinsic regions, as independent claim 1 requires. Petitioner relies on Keller’s disclosure of this limitation for each of its unpatentability challenges of independent claim 1, and claims 2–4 and 6–8, which depend therefrom. Pet. 10–11, 27. Petitioner does not direct us to any portions of Chakraborty, Wirth, Tanimoto, or Tanaka that cure this deficiency. As a result, Petitioner has failed to establish a reasonable likelihood of showing claims 1–4 and 6–8 would have been unpatentable over the combined teachings of Keller, Chakraborty, Wirth, Tanimoto, or Tanaka.

E. Alleged Obviousness based on Wirth in view of AAPA and Keller

Petitioner contends that claims 9 and 10 are unpatentable as obvious over the combined teachings of Wirth, AAPA, and Keller, and claim 11 is unpatentable as obvious over the combined teachings of Wirth, AAPA, Keller, and Tanaka. Pet. 3, 53–73. Patent Owner challenges Petitioner’s assertions. Prelim. Resp. 60–68.

1. Wirth (Ex. 1007)

Wirth is directed to optoelectronic components “comprising a semiconductor function region with an active zone and a lateral main direction of extension.” Ex. 1007, 1:20–24. Wirth aims to provide a simplified, low-cost method for producing these optoelectronic components. Ex. 1007, 1:58–62.

Wirth depicts one embodiment of its invention in Figure 2, reproduced below.

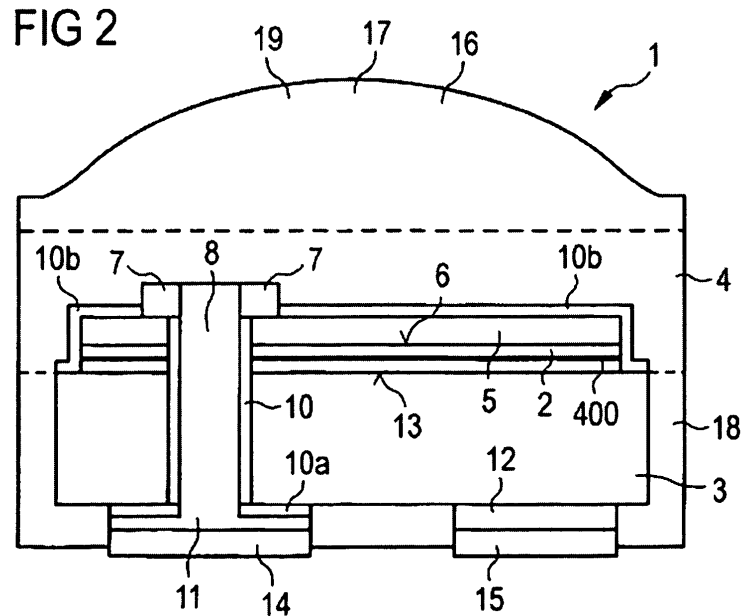
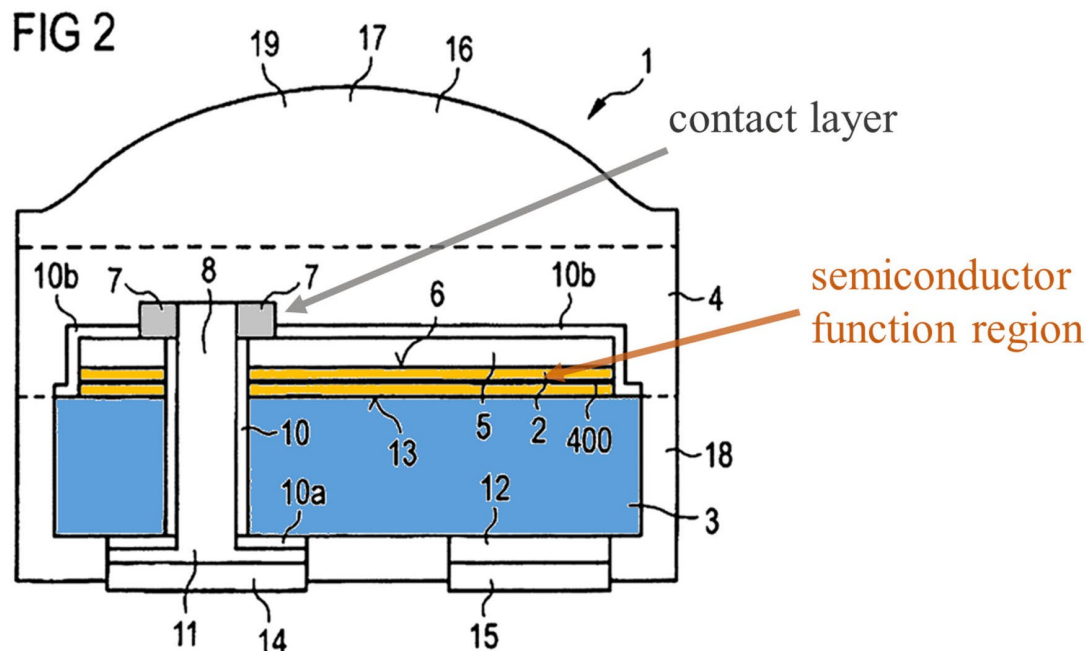


Figure 2 of Wirth shows a schematic sectional view of an optoelectrical component comprising semiconductor function region 2, with active zone 400, carrier 3, envelope 4, current spreading layer 5, first contact layer 7, connecting conducting material 8, isolation material 10, first interconnect 11, second interconnect 12, first solder layer 14, second solder layer 15, and encapsulation 16 including window 17. Ex. 1007, 17:45–46, 18:55–22:46. Wirth explains that functional semiconductor layer 2 has first main face 6 and second main face 13. Ex. 1007, 21:62–64. Wirth further explains that current spreading layer 5 is disposed on the side of semiconductor function region 2 facing away from carrier 3, and contact layer 7 is “[d]isposed after, preferably immediately after, the current spreading layer 5 as viewed from the first main face 6 of the semiconductor function region.” Ex. 1007, 19:35–39.

2. Analysis

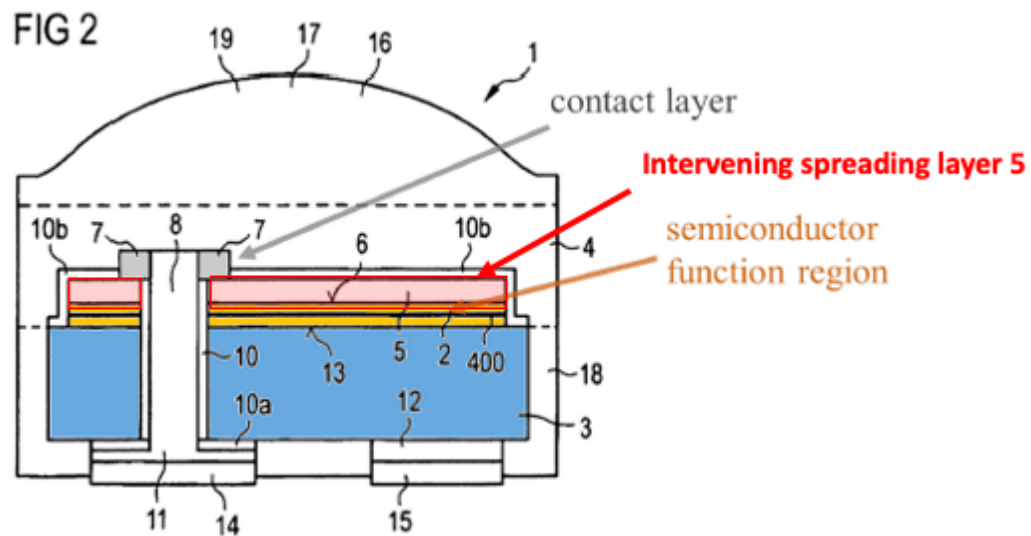
Independent claim 9 of the '137 patent recites, *inter alia*, “growing a plurality of doped layers in a light emitting device (LED) on a substrate; depositing a metallic interface onto said LED opposite to said substrate . . . lifting off said substrate from said LED, and *forming a metal pad on the newly exposed LED surface.*” Ex. 1001, 8:64–9:4 (emphasis added).

Petitioner contends “Wirth discloses a contact layer 7, which is a metal, on top of the semiconductor function region 2,” and that a person of ordinary skill in the art “would have further understood that the contact layer 7 would have been provided on top of the newly exposed surface of semiconductor function region 2 because that is the surface from which the growth substrate has been removed.” Pet. 62–63 (citing Ex. 1002 ¶¶ 203–205). Petitioner presents an annotated version of Figure 2, reproduced below, in support of its argument.



Petitioner's annotated version of Figure 2 identifies contact layer 7 (highlighted grey), positioned above semiconductor function region 2 (highlighted yellow). Pet. 62.

As Patent Owner points out, however, Figure 2 of Wirth shows contact layer 7 formed on intervening spreading layer 5, with a portion touching isolation layer 10. Prelim. Resp. 62–63. And Wirth explains that first contact layer 7 is “[d]isposed after, preferably immediately after, the current spreading layer 5.” Ex. 1007, 19:35–41; *see* Prelim. Resp. 63 (citing Ex. 1007, 19:35–41); Pet. 62 (citing Ex. 1007, 19:35–41); Ex. 1002 ¶ 203 (citing Ex. 1007, 19:35–41). To emphasize the presence of intervening spreading layer 5, Patent Owner presents its own annotated version of Wirth's Figure 2, reproduced below.



Patent Owner's annotated version of Figure 2 identifies contact layer 7 (highlighted grey), positioned above semiconductor function region 2 (highlighted yellow), with intervening spreading layer 5 (highlighted in red) positioned in between contact layer 7 and semiconductor function region 2. Prelim. Resp. 63.

Although Petitioner and Dr. Baker conclude that first contact layer 7 is “on top” of semiconductor region 2 in Wirth (Pet. 62), neither Petitioner nor Dr. Baker addresses sufficiently intervening spreading layer 5 in Wirth Figure 2. As noted above, claim 9 requires “forming a metal pad *on the newly exposed LED surface*.” Ex. 1001, 9:4 (emphasis added). Petitioner and Dr. Baker discuss exposing the surface of semiconductor region 2 by removing the growth substrate from semiconductor region 2. But neither Petitioner nor Dr. Baker explains adequately how contact layer 7 is *formed on that newly exposed LED surface* of semiconductor region 2 when contact layer 7 is deposited *after* intervening spreading layer 5. See Ex. 1007, 19:35–39 (stating that layer 7 is “[d]isposed after, preferably immediately after, the current spreading layer 5”). Wirth’s disclosure of depositing spreading layer 5 on semiconductor function region 2 undermines Petitioner and Dr. Baker’s assertions that semiconductor function region 2 contains a surface “where a new element can be provided.” Pet. 63. Similarly, the presence of intervening spreading layer 5 between semiconductor function region 2 and contact layer 7 undermines Petitioner’s argument that “contact layer 7 would have been provided on top of the *newly exposed* surface of semiconductor function region 2.” Pet. 63 (emphasis added); Ex. 1002 ¶¶ 204–205.

For all of the foregoing reasons, we determine that Petitioner has failed to demonstrate sufficiently that Wirth discloses or suggests “forming a metal pad on the newly exposed LED surface” as independent claim 9 requires. Petitioner relies on Keller’s disclosure of this limitation for its unpatentability challenges of independent claim 9, and claims 10 and 11, which depend therefrom. Pet. 3, 53–73. Petitioner does not direct us to any portions of AAPA, Keller, or Tanaka that cure this deficiency. As a result,

Petitioner has failed to establish a reasonable likelihood of showing claims 9–11 would have been unpatentable over the combined teachings of Wirth, AAPA, Keller, or Tanaka.

III. CONCLUSION

We determine that Petitioner has not demonstrated a reasonable likelihood of showing at least one of the claims challenged in the Petition would have been unpatentable. Accordingly, for the reasons stated herein, we deny the Petition.

IV. ORDER

In consideration of the foregoing, it is:

ORDERED that the Petition is *denied* and no *inter partes* review as to any claim of the '137 patent is instituted.

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