

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WOLFSPEED, INC. AND
IDEAL INDUSTRIES LIGHTING, LLC d/b/a CREE LIGHTING,
Petitioner,

v.

CAO LIGHTING, INC.,
Patent Owner.

IPR2022-00847
Patent 6,465,961 C2

Before DONNA M. PRAISS, CHRISTOPHER M. KAISER, and
BRIAN D. RANGE *Administrative Patent Judges*.

RANGE, *Administrative Patent Judge*.

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

I. INTRODUCTION

Wolfspeed, Inc. and IDEAL Industries Lighting, LLC d/b/a Cree Lighting (collectively, “Petitioner”) filed a Petition requesting *inter partes* review of claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 of U.S. Patent No. 6,465,961 C2 (Ex. 1001, “the ’961 patent”). Paper 1 (“Pet.”). CAO Lighting, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply to the Preliminary Response. Paper 7 (“Pet. Reply”). Patent Owner filed a Preliminary Sur-reply in response. Paper 8 (“Prelim. Sur-reply”).

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” The following findings of fact and conclusions of law are not final, but are made for the sole purpose of determining whether Petitioner meets the threshold for initiating review. Any final decision shall be based on the full trial record, including any response timely filed by Patent Owner. Any arguments not raised by Patent Owner in a timely-filed response may be deemed waived.

For the reasons stated below, we determine that Petitioner has established a reasonable likelihood that it would prevail with respect to at least one claim. We hereby institute an *inter partes* review as to all of the challenged claims of the ’961 patent based upon Petitioner’s asserted grounds of unpatentability.

II. BACKGROUND

A. *Related Matters*

The parties indicate that the '961 patent is the subject of the following district court proceedings: *CAO Lighting, Inc. v. Cree, Inc. et al.*,¹ No. 1:21-cv-00634 (M.D.N.C.) (“the parallel district court litigation”), *CAO Lighting, Inc. v. GE Lighting, Inc.*, No. 1:20-cv-00681 (D. Del.), *CAO Lighting, Inc. v. OSRAM Sylvania Inc. et al.*, No. 1:20-cv-00690 (D. Del.), *CAO Lighting, Inc. v. Feit Electric Company, Inc.*, No. 2:20-cv-04926 (C.D. Cal.), *CAO Lighting, Inc. v. Lights of America, Inc.*, No. 5:20-cv-02367 (C.D. Cal.), *CAO Lighting, Inc. v. Topaz Lighting Corp.*, No. 2-21-cv-08912 (C.D. Cal.), and *CAO Lighting, Inc. v. Signify NV f/k/a Philips Lighting NV et al.*, No. 2-21-cv-08972 (C.D. Cal.). Pet. 133–134; Paper 4, 1–2.

Patent Owner also identifies the following proceedings as related matters: *CAO Group v. GE Lighting et al.*, 2-11-cv-00426 (District of Utah), *CAO Lighting, Inc. v. Light Efficient Design et al.*, 4-16-cv-00482 (originally filed in District of Idaho), 1-17-cv-07359 (transferred to Northern District of Illinois), *inter partes* Reexamination Control No. 95/000,680, and *inter partes* Reexamination Control No. 95/002,324. Paper 4, 1.

B. *The '961 Patent*

The '961 patent originally issued with claims 1–20. Ex. 1001, 9:52–12:63. After a first reexamination, claims 8 and 9 were cancelled and new claims 21–103 were added. *Id.* at p. 26, Ex Parte Reexamination Certificate

¹ Petitioner states that “Cree, Inc., a named defendant in the Underlying Litigation, is now Wolfspeed, Inc.” Pet. 133 n.3. Petitioner identifies this case as “the district court case” or “Underlying Litigation” that involves the parties. *Id.* at 19.

(“EPRC”) 1:26–8:62. Claims 1–7 and 10–20 were cancelled by an additional reexamination. *Id.* at p. 31, Inter Partes Reexamination Certificate (“IPRC”) 1:10–12.

The ’961 patent is titled “Semiconductor Light Source Using a Heat Sink with a Plurality of Panels.” *Id.* at code (54). According to the ’961 patent, “[p]rior art semiconductor light sources have not been successfully and economically used to illuminate physical spaces.” *Id.* at 1:20–22. The ’961 patent states that “[t]ypical prior art LED modules lack high light intensity due to the size of the LED chips used.” *Id.* at 1:23–25. In view of this, the ’961 patent states there is a need “in the prior art for a semiconductor light source for use in illuminating a space with single color light in the visible range and which can efficiently dissipate the heat that they produce.” *Id.* at 1:46–49.

We reproduce Figure 1 of the ’961 patent below.

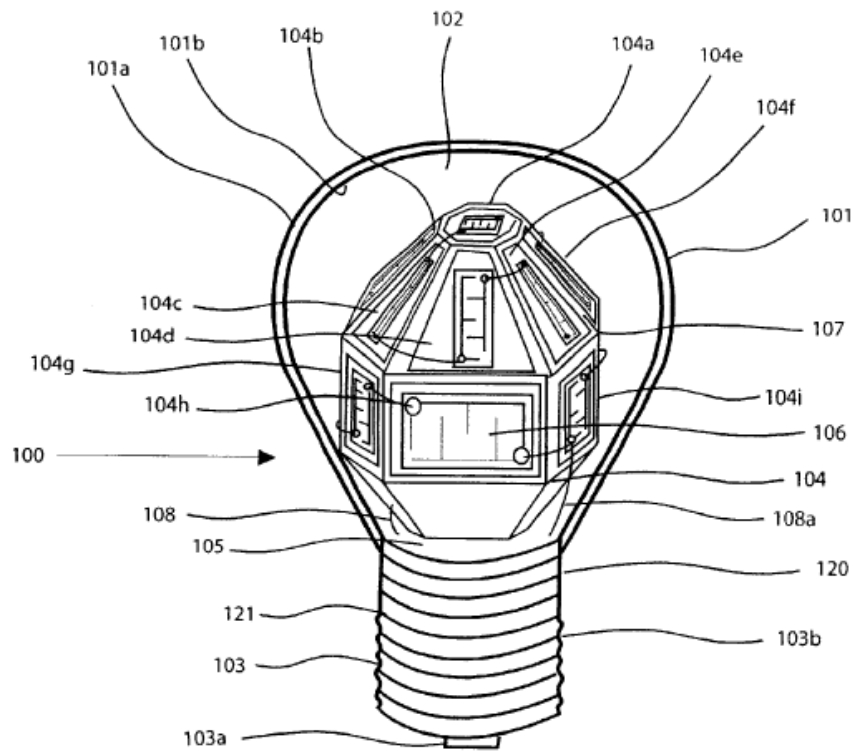


Fig. 1

Figure 1 shows a semiconductor light source that uses a high power chip or array arrangement. *Id.* at 1:65–67. Semiconductor light source 100 includes enclosure 101 having interior volume 102. *Id.* at 2:48–52, 3:9. Enclosure 101 may be mounted to support 105. *Id.* at 3:15. Semiconductor light source 100 further includes base 103, which “may be configured as a fitting or connector for use in a desired light socket.” *Id.* at 3:17–18. Heat sink 104 is further located within interior volume 102. *Id.* at 3:22–23. The ’961 patent describes heat sink 104 as having “a generally flat or planar top 104a, and a plurality of generally flat or planar panels or compartment 104b, 104c, 104d, 104e, 104f, 104g, 104h, 104i, etc. each of which may host a single or an array of semiconductor devices capable of producing light.” *Id.* at 3:24–29. In addition, at least one semiconductor device 106 is mounted on heat sink

104. *Id.* at 3:37–38. The '961 patent describes the use of “high power” LEDs by stating that “[h]igh power’ LED’s means that the light output from each LED module is greater than 40 milliwatts.” *Id.* at 4:6–8.

We reproduce Figure 3d of the '691 patent below.

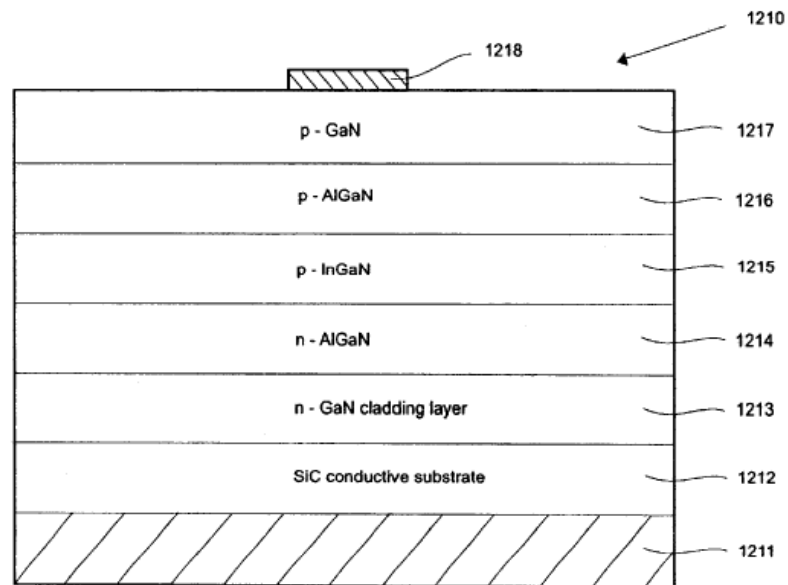


Fig. 3d

Figure 3d illustrates an LED structure on a substrate. *Id.* at 2:9–10. The structure includes electrically conductive substrate 1212, buffer layer 1213, cladding layer 1214, active layer 1215 where energy is converted to light, cladding layer 1216, and contact layer 1217. *Id.* at 5:11–20.

We reproduce Figure 3d of the '691 patent below.

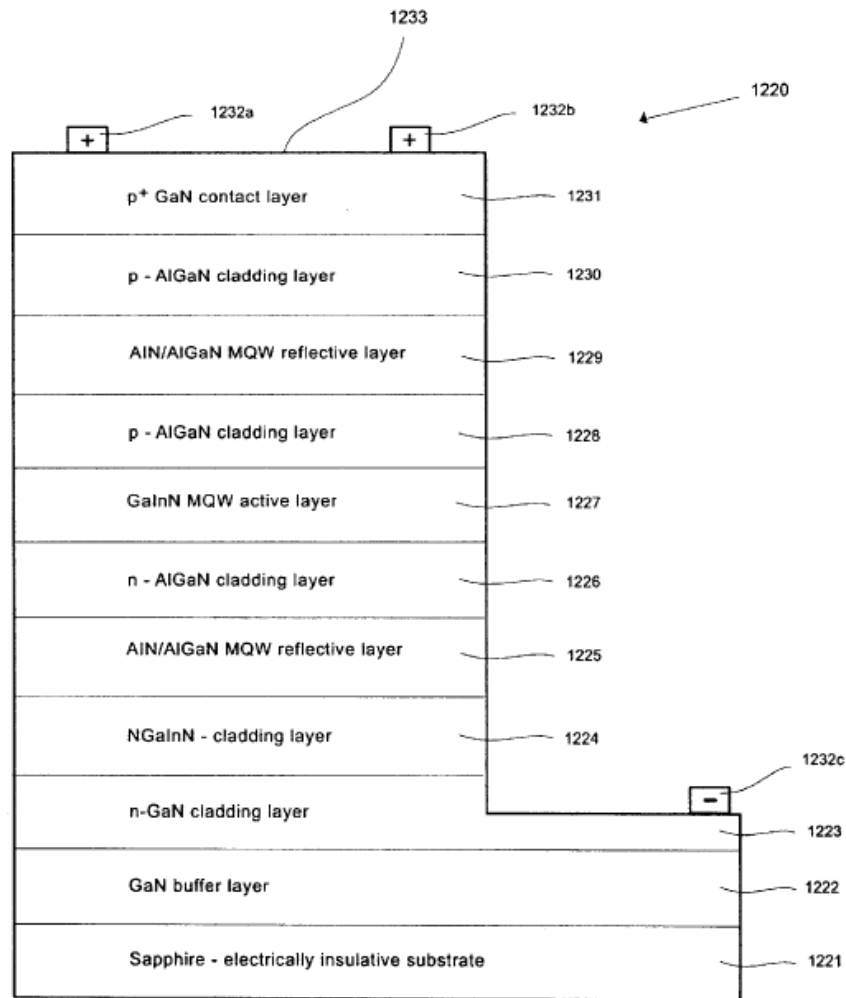


Fig. 3f

Figure 3f depicts a VCSEL chip on an insulative substrate. *Id.* at 2:12–13. VCSEL chip 1220 includes substrate 1221, buffer layer 122, cladding layer 1223, another cladding layer 1224, reflective layer 1225, cladding layer 1226, active layer 1227, another cladding layer 1228, second reflective layer 1229, cladding layer 1230, and contact layer 1231. *Id.* at 5:31–49. The '961 patent explains that “[l]ight emitted from the active layer reflects between the two reflective layers until it reaches an appropriate energy level and then lases, emitting a laser beam of light.” *Id.* at 5:45–48.

C. Illustrative Claims

Petitioner challenges claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91. Pet. 11. Claim 21 depends from claim 8, which was cancelled via reexamination. Ex. 1001, EPRC 1:32–39. Claim 8 depended from claim 7, which depended from claim 1. *Id.* at 10:27–44. Claims 7 and 1 were also cancelled via reexamination. *Id.* at IPRC 1:10–13. The remaining challenged claims depend from claim 21. *Id.* at EPRC 1:40–8:62. Therefore, we treat claim 21 as the sole independent claim. To reflect claim 21’s full scope, we reproduce claims 1, 7, 8, and 21 below.

1. A semiconductor light source for emitting light to illuminate a space used by humans, the semiconductor light source comprising:
 - an enclosure, said enclosure being fabricated from a material substantially transparent to white light,
 - an interior volume within said enclosure,
 - a heat sink located in said interior volume,
 - said heat sink being capable of drawing heat from one or more semiconductor devices,
 - said heat sink having a plurality of panels on it suitable for mounting semiconductor devices thereon,
 - said panels on said heat sink being oriented to facilitate emission of light from the semiconductor light source in desired directions around the semiconductor light source,
 - at least one semiconductor chip capable of emitting light mounted on one of said panels,
 - said semiconductor chip being capable of emitting monochromatic light,
 - said semiconductor chip being selected from the group consisting of light emitting diodes, light emitting diode arrays,

laser chips, LED modules, laser modules, and VCSEL chips,
and

a coating for converting monochromatic light emitted by
said chip to white light.

7. A device as recited in claim 1 wherein said chip includes
a substrate on which epitaxial layers are grown,

a buffer layer located on said substrate, said buffer layer
serving to mitigate differences in material properties between
said substrate and other epitaxial layers,

a first cladding layer serving to confine electron
movement within the chip, said first cladding layer being
adjacent said buffer layer,

an active layer, said active layer emitting light when
electrons jump to a valance state,

a second cladding layer, said second cladding layer
positioned so that said active layer lies between cladding layers,
and

a contact layer on which an electron may be mounted for
powering said chip.

8. A device as recited in claim 7 further comprising a first
and a second reflective layers, each of said first and second
reflective layers being located on opposite sides of said active
layer, said reflective layers serving to reflect light emitted by
said active layer.

21. The semiconductor light source as recited in claim 8
wherein:

said at least one semiconductor chip is a light emitting
diode (LED) chip configured to output light at greater than
about 40 milliwatts, and

said LED chip is configured to emit monochromatic visible light.

Ex. 1001, 9:52–10:10, 10:28–43, 10:44–48, EXRC 1:32–48.

D. Asserted Grounds of Unpatentability

Petitioner, supported by the declaration of Michael S. Lebby, Ph.D. (Ex. 1006), asserts the following three grounds of unpatentability (Pet. 13):²

Claims Challenged	35 U.S.C. §	References/Basis
21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, 88–91	103(a)	Begemann, ³ Krames, ⁴ Allen ⁵
21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, 88–91	103(a)	Begemann, Nakamura ⁶ , Allen, Krames
21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, 88–91	103(a)	Begemann, Sugiura ⁷ , Allen, Krames

² The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. The application that issued as the ’961 patent was filed before this date. *See* Ex. 1001, code (22). For the purposes of this Decision, pre-AIA statutes apply.

³ WO 00/17569, published March 30, 2000, Ex. 1007 (“Begemann”).

⁴ Krames et al., *High-brightness AlGaInN light-emitting diodes*, Proc. SPIE 3938, LIGHT-EMITTING DIODES: RESEARCH, MANUFACTURING, AND APPLICATIONS IV (2000), Ex. 1008 (“Krames”).

⁵ WO 99/57945, published November 11, 1999, Ex. 1011 (“Allen”).

⁶ US 5,777,350, issued July 7, 1998, Ex. 1009 (“Nakamura”).

⁷ US 6,015,979, issued January 18, 2000, Ex. 1010 (“Sugiura”).

III. ANALYSIS

A. *Legal Standard*

A patent claim is unpatentable under 35 U.S.C. § 103(a) 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 in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. *Level of Ordinary Skill in the Art*

In order to determine whether an invention would have been obvious at the time the application was filed, we consider the level of ordinary skill in the pertinent art at critical time. *Graham*, 383 U.S. at 17. The resolution of this question is important because it allows us to “maintain[] objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quotation omitted). Generally, it is easier to establish obviousness under a higher level of ordinary skill in the art. *Innovation Toys, LLC v. MGA*

Entm't, Inc., 637 F.3d 1314, 1323 (Fed. Cir. 2011) (“A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.”).

Petitioner asserts:

As of the '961 Patent's claimed priority date (August 24, 2001), a POSITA would have had at least a bachelor's degree in an engineering discipline with coursework in semiconductors and/or optoelectronics, and three or more years of experience working in the semiconductor and/or optoelectronics fields. Less work experience may be compensated by a higher level of education with the foregoing coursework.

Pet. 20 (citing Ex. 1006 ¶ 34). Patent Owner does not dispute Petitioner's definition of one of ordinary skill in the art. *See generally* Prelim. Resp.

Petitioner's description appears consistent with the prior art and patent specification before us and is supported by witness testimony. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (prior art itself may reflect an appropriate level of skill). For the purpose of this Decision, we adopt Petitioner's description.

C. Claim Construction

In an *inter partes* review proceeding based on a petition filed on or after November 13, 2018, a patent claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (as amended Oct. 11, 2018). This rule adopts the same claim construction standard used by Article III federal courts, which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. Under this standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary

skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Petitioner contends that “[t]he terms in the Challenged Claims should receive their ordinary and customary meaning as understood by a POSITA in the context of the patent specification and prosecution history.” Pet. 19 (citing Ex. 1006 ¶ 71). Petitioner states that “Patent Owner has taken a position as to the scope of certain claim terms through infringement contentions in the district court case.” *Id.* Specifically, Petitioner avers that Patent Owner proposes claim constructions for the term “reflective layers” and contends that grounds 1 and 3 demonstrate invalidity even under Patent Owner’s interpretation of “reflective layers.” *Id.* at 20 (citing Ex. 1017, 22–23; Ex. 1006 ¶ 72).

Patent Owner contends that the petition fails to show a reasonable likelihood that Petitioner would prevail for at least one claim because Petitioner has not identified how the challenged claims are to be construed or how the asserted references apply to any construed claim. Prelim. Resp. 4–10; Prelim. Sur-reply 1–3. Patent Owner further contends that the petition violates 37 C.F.R. § 42.104(b)(3) because it does not, for each claim challenged, identify “how the challenged claim is to be construed” and “how the construed claim is unpatentable.” Prelim. Sur-reply 1. In particular, Patent Owner emphasizes that two district courts have construed various terms of the ’961 Patent and that Petitioner does not address these constructions. Prelim. Resp. 4–10.

Patent Owner’s argument does not persuade us that institution is inappropriate here. Petitioner identified how each challenged claim is to be construed by asserting that “ordinary and customary meaning” applies.

Pet. 19. Petitioner also explained how each challenged claim is unpatentable. *Id.* at 32–30. Moreover, Petitioner explains that its challenges are sufficient under the District Court’s claim constructions. Pet. Reply 4. Patent Owner does not persuasively identify how the District Court claim constructions undermine Petitioner’s challenges and do not persuasively explain how the asserted art fails to disclose or suggest claim 21’s recitations. Under these circumstances, the petition satisfies 37 C.F.R. § 42.104(b)(3).

As we explain below, Petitioner establishes a reasonable likelihood that it would prevail with respect to at least one claim based on ordinary and customary meaning. Thus, we determine that no claim terms require express construction for purposes of this Decision. *See, e.g., Nidec Motor Corp. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[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))). We also further address claim 8’s recitation of “reflective layers” when addressing that claim recitation in the context of the prior art.

D. Discretionary Denial under 35 U.S.C. § 314(a)

Patent Owner argues that we should exercise our discretion under 35 U.S.C. § 314(a) and not institute trial, given the state of the parallel district court litigation. Prelim. Resp. 10–22. For the reasons stated below, we do not exercise our discretion to deny institution in view of the parallel proceeding.

Institution of an *inter partes* review is discretionary. *See* 35 U.S.C. § 314(a) (authorizing institution of an *inter partes* review under particular circumstances, but not requiring institution under any circumstances);

Cuozzo Speed Techs., LLC v. Lee, 136 S. Ct. 2131, 2140 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018) (“[Section] 314(a) invests the Director with discretion on the question whether to institute review” (emphasis omitted)); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d at 1356, 1367 (Fed. Cir. 2016) (“[T]he PTO is permitted, but never compelled, to institute an IPR proceeding.”).

When determining whether to exercise discretion to deny institution in view of a parallel proceeding, the *Fintiv* decision considered the following factors:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board’s exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). “These factors relate to whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding.” *Id.*

On June 21, 2022, the Director of the U.S. Patent and Trademark Office (“USPTO”) issued a Memorandum⁸ titled “Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings With Parallel District Court Litigation.” The Memorandum states that “the precedential import of *Fintiv* is limited to the facts of that case.” Memorandum at 2. The Memorandum also states that “the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” *Id.* at 3. The Memorandum further states that “where the PTAB determines that the information presented at the institution stage presents a compelling unpatentability challenge, that determination alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*.” *Id.* at 4–5. Further, “[c]ompelling, meritorious challenges are those in which the evidence, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.” *Id.* at 4.

Here, Petitioner stipulates that they “will not assert, in the parallel district court proceeding, that any Challenged Claim is invalid based on (a) the same grounds as those in the Petition, or (b) any grounds that reasonably could have been raised in the Petition.” Pet. Reply 7. The stipulation eliminates the possibility of Petitioner asserting duplicative invalidity grounds in both the Petition and in District Court. The Director’s guidance that “PTAB will not discretionarily deny institution” in view of a stipulation

⁸ Available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

such as Petitioner’s stipulation here is sufficient for us to decline to discretionarily deny institution. Memorandum, 7. We also determine that Petitioner’s stipulation is timely because it is offered prior to our decision on institution. *See NXP USA, Inc. v. Impinj, Inc.*, IPR2021-01556, Paper 13 (PTAB Sept. 7, 2022) (precedential) (“the only appropriate time for a petitioner to offer a stipulation related to the *Fintiv* factor 4 analysis is prior to the Board’s decision of whether to institute review”).

Alternatively, even if we were to consider the *Fintiv* factors, the factors would not favor a discretionary denial of institution. Because of the stipulation, factor four weighs heavily against discretionary denial. With regard to factor six, Petitioner presents compelling evidence that, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence. Pet. 11 (summarizing arguments on merits). We explain this compelling evidence in our merits analysis below. Patent Owner does not, at this stage, provide evidence or argument substantially weighing against Petitioner’s argument on the merits. Thus, an analysis of the *Fintiv* factors as a whole would weigh at least factors four and six heavily against exercising discretion, and the remaining factors would not outweigh these factors.

For the reasons above, we determine that the circumstances presented here do not support exercising our discretion under § 314(a) to deny institution of this *inter partes* review.

E. Overview of the Asserted Art

1. Begemann (Exhibit 1007)

Begemann describes “a LED lamp comprising a gear column, a lamp cap which is connected to an end of the gear column and a substrate which is

connected to the other end of the gear column and which is provided with a number of LEDs.” Ex. 1007, 1:1–3.

We reproduce Begemann’s Figure 2 below.

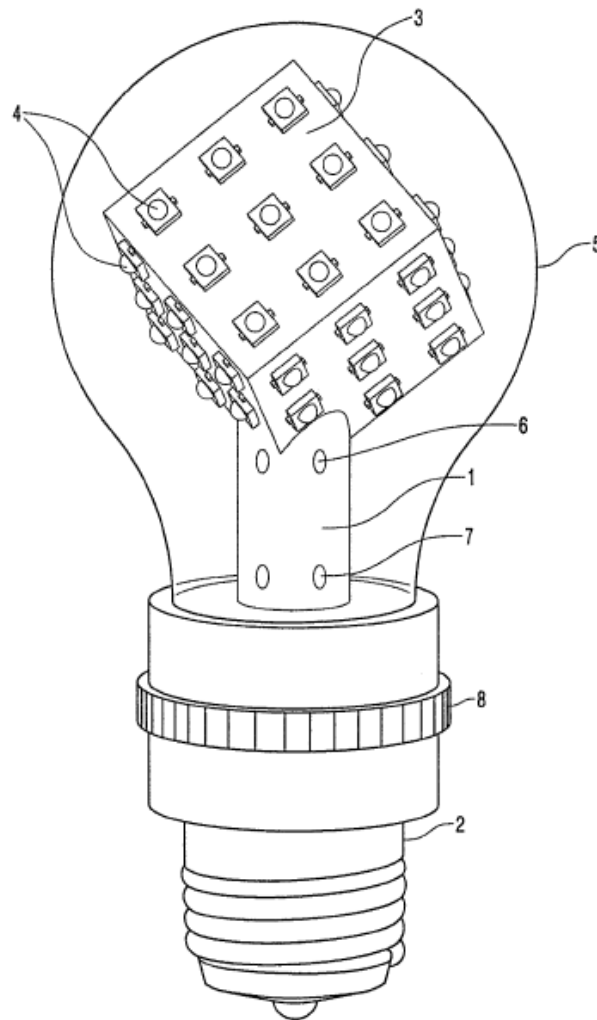


FIG. 2

Figure 2 depicts an embodiment of a LED lamp. *Id.* at 4:11. LED lamp includes gear column 1, metal lamp cap 2, metal substrate 3 having LEDs 4, envelope 5, and outlet holes 6 and inlet holes 7 for air flow. *Id.* at 5:13–16. Begemann describes substrate 6 as cube-shaped and states that each one of the faces has a number of LEDs 4. *Id.* at 5:17–18, 21–22. Begemann

explains that multiple-chip LEDs are used in this embodiment, “which each have three light points (green, red and blue) per LED or four light points (green, red, yellow, blue) per LED” and “[t]hese colors are mixed so as to obtain white light in the secondary optical system of each of the LEDs.” *Id.* at 5:22–25.

We reproduce Begemann’s Figure 3A below.

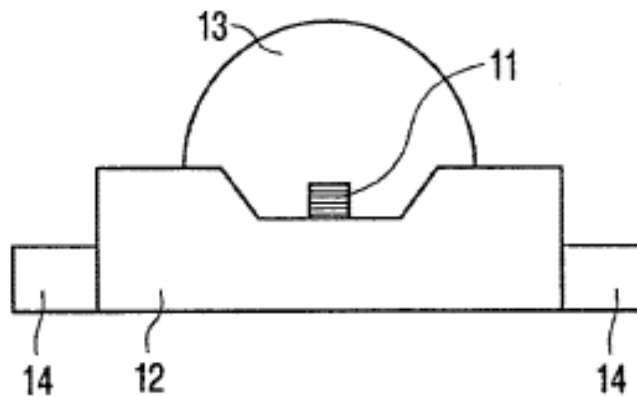


FIG. 3A

Figure 3A shows a LED that includes single-chip LEDs, which each has only one light point 11 per LED. *Id.* at 6:3–5. Begemann explains that “[l]ight point (11) is provided with a primary optical system(13), by means of which the radiation characteristic of the LED can be influenced.” *Id.* at 6:6–8.

2. *Krames (Exhibit 1008)*

Krames is a paper titled “High-brightness AlGaInN light-emitting diodes.” Ex. 1008, 1. Specifically, Krames describes AlGaInN LEDs grown via organometallic vapor phase epitaxy (“OMVPE”). *Id.* Krames describes a light output versus current characteristic of 170 mW at a drive current of 1.5 A DC for a blue (wavelength of about 470 nm) 1 x 1 mm² AlGaInN LED.

Id. at 10.

Krames's Figure 3 is reproduced below.

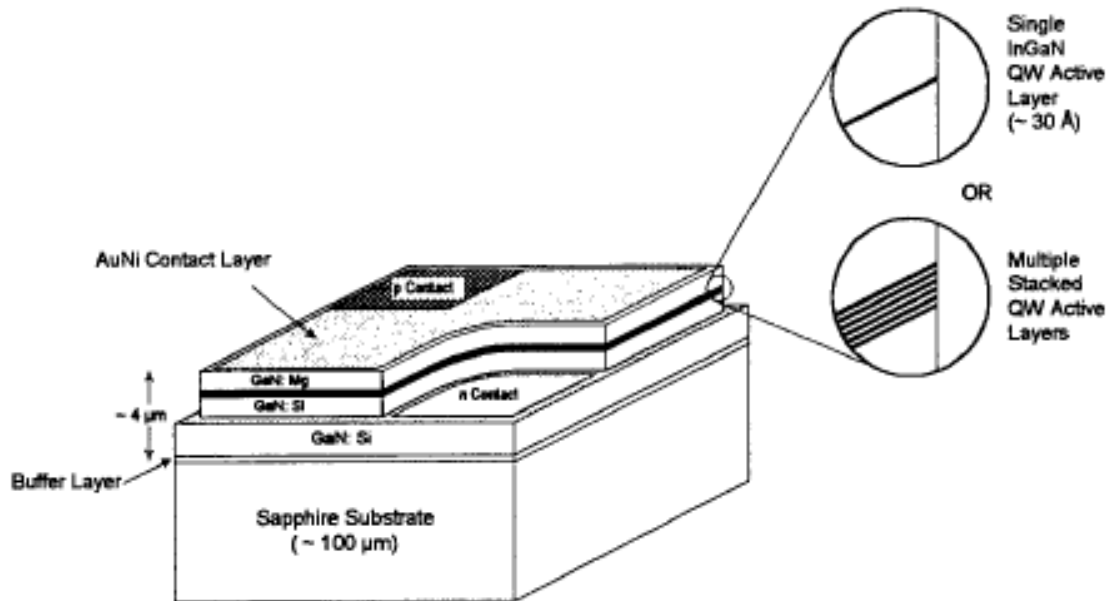


Fig. 3. Typical AlGaInN LED structure.

Figure 3 depicts a typical AlGaInN LED structure. *Id.* at 4. Krames discloses that “[t]he two most common substrates used for OMVPE growth of AlGaInN are sapphire and SiC.” *Id.* Krames explains that “[s]apphire is insulating and therefore both p and n Ohmic contacts must be formed on the top surface of the LED chip.” *Id.* The n-type contact is formed by mesa etching the AlGaInN LED structure to expose n-type GaN layers beneath the active region and then applying an ohmic n-contact metallization (e.g., Ti/Al) to the n-type GaN. *Id.* Krames states that the p-type contact is formed “by depositing a semi-transparent Ni/Au Ohmic contact metallization across the GaN:Mg surface.” *Id.*

3. Allen (Exhibit 1011)

Allen describes a lamp that includes one or more monolithic LED devices that each has an array of LED dies. Ex. 1011 code (57). Allen states

that the “[t]he array of LED dies may comprise a mixture of RGB sub-dies or ‘white dies’ or a mixture of both types of dies” and that “[w]hite dies may be, for example, blue dies with phosphorescent coating to produce a wideband spectrum.” *Id.* at 4:9–12.

We reproduce Allen Figures 6A and 6B below.

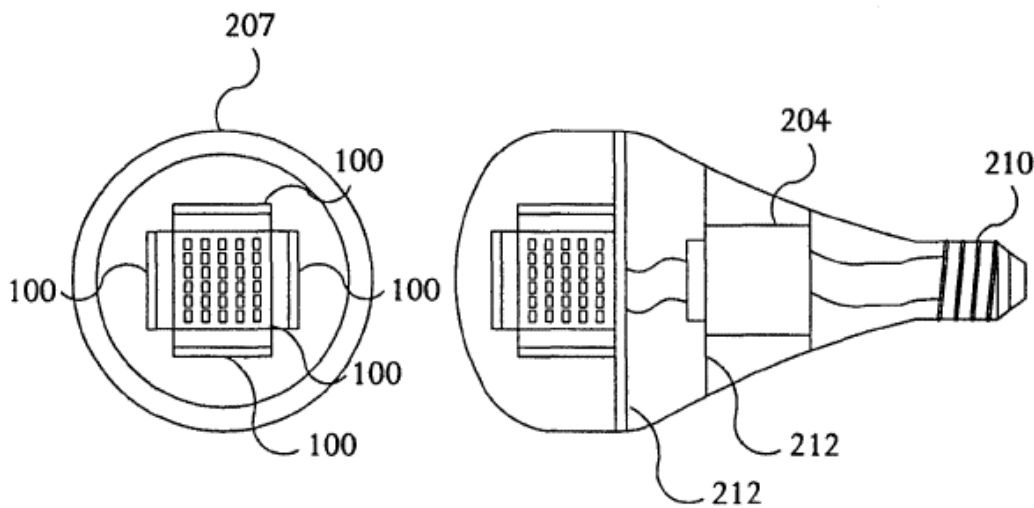


FIG. 6A

FIG. 6B

Figure 6A depicts a top view of an “A-type” screw-in hemispherical lamp configuration. *Id.* at 3:17–18. Figure 6B shows a side view of the hemispherical lamp. *Id.* at 3:19–20. The lamp includes monolithic LED device 100, lamp housing 207, mounting brackets 212, voltage converter 204, and base 210. *Id.* at 6:10–12. Allen states that voltage converter 204 “may be a transformer, such as step-down transformer, series resistor, or other type of voltage converter employed in the art to convert from a supply voltage such as an AC or DC supply followed by a bridge rectifier circuit.” *Id.* at 6:16–18.

4. Nakamura (Ex. 1009)

Nakamura describes “a semiconductor light-emitting device such as a light-emitting diode (LED) or a laser diode (LD).” Ex. 1009, 1:7–9. We reproduce Nakamura Figure 11.

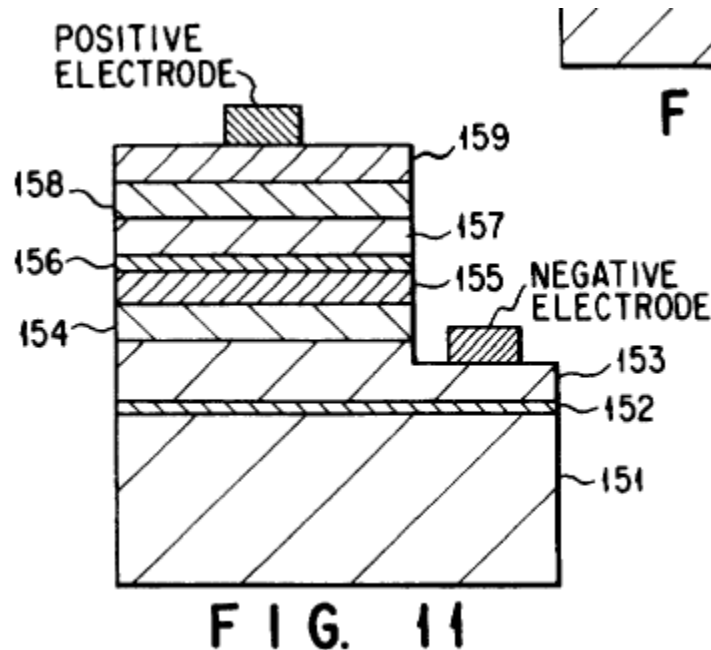


Figure 11 is a cross-sectional view of a light-emitting device. *Id.* at 5:58–60. The light-emitting device includes substrate 151, buffer layer 152, n-type contact layer 153, second n-type clad layer 154, first n-type clad layer 155, active layer 156, second p-type clad layer 158, and p-type contact layer 159. *Id.* at 19:45–54. Nakamura further discloses that it is possible to dispose a light-reflecting film “consisting of at least two kinds of nitride semiconductor layers, each differing in composition” on an outer side of first n-type clad layer 155 and/or a second multi-layer film “consisting of at least two kinds of nitride semiconductor layers, each differing in composition” on an outer side of second p-type clad layer 158. *Id.* at 21:47–55.

5. *Sugiura (Ex. 1010)*

Sugiura describes “a nitride-based semiconductor element such as a semiconductor laser, a light-emitting diode, an electronic device, or the like.” Ex. 1010, 1:6–8. Sugiura’s Figure 7 is reproduced below.

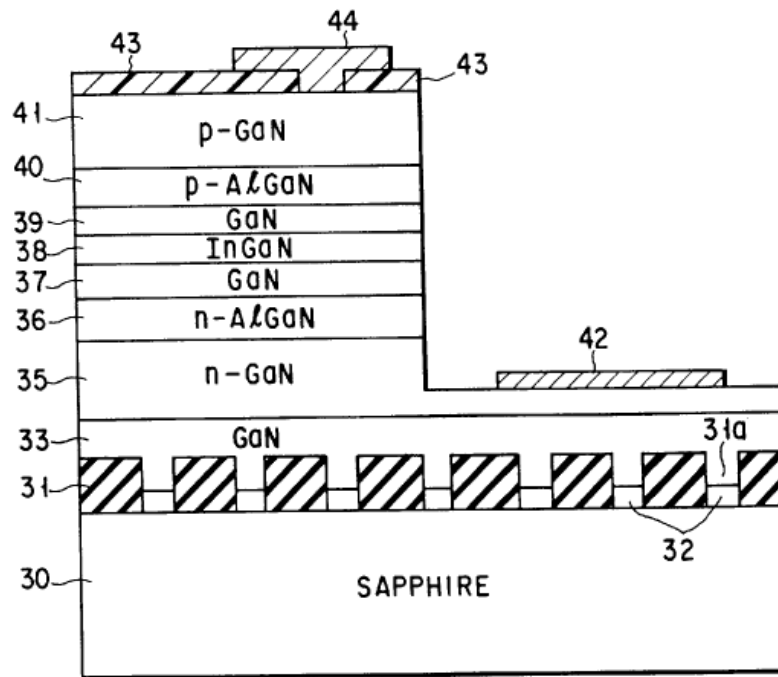


FIG. 7

Figure 7 illustrates a sectional view of a nitride-based semiconductor laser. *Id.* at 9:1–3. The nitride-based semiconductor laser includes sapphire substrate 30, mask 31 having grooves 31a, low-temperature GaN buffer layer 32, undoped underlying GaN layer 33, n-type GaN contact layer 35, n-type AlGaIn current injection layer 36, n-type GaN optical guide layer 37, InGaIn active layer 38, p-side GaN optical guide layer 39, p-type AlGaIn current injection layer 40, and p-type GaN contact layer 41. *Id.* at 12:24–36. Sugiura states that “[a]lthough this embodiment has been described above with reference to the case it is applied to a laser, but the present invention

can be applied not only to a nitride-based semiconductor laser but also to a light-emitting diode.” *Id.* at 14:58–61.

F. Unpatentability Grounds

1. Unpatentability over Begemann, Krames, and Allen

Petitioner asserts that claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable under 35 U.S.C. § 103(a) as obvious over Begemann, Krames, and Allen, citing the Declaration of Dr. Michael S. Lebby for support. Pet. 32–104 (citing Ex. 1006). We have reviewed Petitioner’s arguments and evidence and have found them to be sufficient to meet the threshold of § 314(a). Patent Owner does not persuasively dispute Petitioner’s positions. Below, we address claim 21 while addressing dependent claims collectively.

a. Claim 21

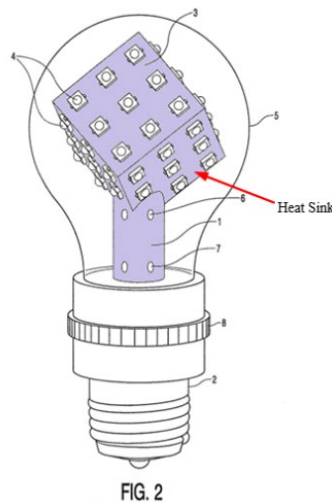
Claim 21 depends from cancelled claims 1, 7, and 8. The preamble of claim 1 recites, “A semiconductor light source for emitting light to illuminate a space used by humans, the semiconductor light source comprising.” Petitioner argues that Begemann discloses a semiconductor light source. Pet. 32–33. Based on the current record, we find Petitioner’s assertion to be persuasive and supported by evidence. Ex. 1007, 6:23–24, Fig. 2; Ex. 1006 ¶ 98.

Claim 1 next recites “an enclosure, said enclosure being fabricated from a material substantially transparent to white light.” Petitioner argues that Begemann teaches this recitation. Pet. 33–34. Based on the current record, we find Petitioner’s assertion to be persuasive and supported by evidence. Begemann states, for example, that “during operation of the LED

lamp shown, white light is obtained” and that the Begemann device has an “envelope ... made of glass [or] synthetic resin.” Ex. 1007, 2:23–24, 5:26; *see also id.* at Fig. 2; Ex. 1006 ¶ 99.

Claim 1 next recites “an interior volume within said enclosure.” As Petitioner asserts, Begemann teaches this recitation. Pet. 34–35, Ex. 1007, Fig. 2; Ex. 1006 ¶ 100.

Claim 1 next recites “a heat sink located in said interior volume.” Petitioner identifies such a sink by annotating Figure 2. Pet. 35–37. We reproduce that annotated figure below.



Pet. 35–36 (reproducing Ex. 1006, Fig. 2). Begemann Figure 2 is a view of a second embodiment of Begemann’s LED lamp. Ex. 1007, 4:11. Petitioner annotates the Figure to identify heat sink areas. Based on the current record, we find Petitioner’s assertion to be persuasive and supported by evidence. Begemann teaches, for example, that substrate 3 is made of a metal or metal alloy, thereby enabling a good heat conduction and that the outer surface of the gear column (1) of the LED lamp is made of a metal or a metal alloy enabling good heat conduction. *Id.* at 5:1–21; *see also* Ex. 1006 ¶ 101.

Claim 1 next recites “said heat sink being capable of drawing heat from one or more semiconductor devices.” For the reasons we address above, based on the current record, we find Petitioner’s identification of such a heat sink to be persuasive and supported by evidence. Pet. 37.

Claim 1 next recites “said heat sink having a plurality of panels on it suitable for mounting semiconductor devices thereon.” Petitioner annotates Figure 2 to identify a plurality of panels. Pet. 37–38. Based on the current record, we find Petitioner’s identification of these panels to be persuasive and supported by evidence. *See* Ex. 1007, Fig. 2; Ex. 1006 ¶ 103.

Claim 1 next recites “said panels on said heat sink being oriented to facilitate emission of light from the semiconductor light source in desired directions around the semiconductor light source.” Petitioner again annotates Figure 2 to illustrate how Begemann teaches this recitation. Pet. 38–39. Based on the current record, we find Petitioner’s identification to be persuasive and supported by evidence. *See* Ex. 1007, Fig. 2; Ex. 1006 ¶ 104.

Claim 1 next recites “at least one semiconductor chip capable of emitting light mounted on one of said panels.” Petitioner annotates Begemann Figures 2 and 3A to illustrate how Begemann teaches this recitation. Pet. 39–40. Based on the current record, we find Petitioner’s identification to be persuasive and supported by evidence. Ex. 1007, Figs. 2, 3A; Ex. 1006 ¶ 105.

Claim 1 next recites “said semiconductor chip being capable of emitting monochromatic light.” Petitioner argues that Begemann teaches this recitation. Pet. 40. Based on the current record, we find Petitioner’s assertion to be persuasive and supported by evidence. Begemann teaches that its “single chip LEDs” have “only one light point per LED.” Ex. 1007, 4:32–

34.⁹ Begemann explains, for example, that its green, red, yellow, blue light points may be mixed to obtain white light. *Id.* at 5:17–26. Petitioner’s witness, Dr. Lebby, testifies that having only one light point means the light is monochromatic. Ex. 1006 ¶ 106.

Claim 1 next recites “said semiconductor chip being selected from the group consisting of light emitting diodes, light emitting diode arrays, laser chips, LED modules, laser modules, and VCSEL chips.” As Petitioner asserts, Begemann teaches that its chips are LEDs. Pet. 40–41; Begemann 6:4–5, Fig. 3A; Ex. 1006 ¶ 107.

Claim 1 next recites “a coating for converting monochromatic light emitted by said chip to white light.” Petitioner asserts that Allen and Krames teach such a coating. Pet. 41. Based on the current record, we find Petitioner’s assertion to be persuasive and supported by evidence. *See* Ex. 1011, 4:11–12 (Allen stating that “[w]hite dies may be, for example, blue dies with phosphorescent coating to produce a wideband spectrum”); Ex. 1008, 11 (Krames explaining “conversion of blue light into white via phosphors”); Ex. 1006 ¶¶ 108–109).

Petitioner also asserts that a person of skill in the art would have had reason to combine the teachings of Allen and Krames with Begemann. Pet. 27–32. Based on the current record, we also determine that Petitioner’s assertion is persuasive and supported by evidence. Begemann teaches the use of LED chips for its LED lamp, but it does not describe the details of its LED chips. Ex. 1007, 1:1–4, 4:21–22. A person of skill in the art seeking to implement Begemann’s teachings would have looked to other references,

⁹ Petitioner mistakenly cites 3:32–35 (Pet. 40), but the quote is easily located on the next page.

such as Krames and Allen, to learn more about the structure of high-power LED chips. Ex. 1006 ¶¶ 91–94.

Krames teaches a chip that appears suitable for use in Begemann’s package. Pet. 29–30. Krames teaches that its chip “should be able to compete more favorably with conventional lighting technologies in many applications.” Ex. 1008, 6. This matches Begemann’s LED Lamps. Ex. 1007, 2:3–5. A person of ordinary skill in the art would have had a high expectation of success in mounting Krames’s chips within Begemann given, for example, the heat dissipation Begemann teaches (as explained above). Ex. 1006 ¶ 93. On the present record, Petitioner adequately establishes that a person of ordinary skill in the art would have reason to implement Krames’s chip design with Begemann with a high expectation of success.

As to Allen, Begemann teaches a “white LED” for at least one embodiment. Pet. 31 (quoting Ex. 1007, 3:6–9). Krames teaches conversion of blue light into white “via phosphors” and Allen teaches that “blue dies with phosphorescent coating” may be used. Ex. 1008, 11; Ex. 1011, 4:11–12; Ex. 1006 ¶¶ 95–96. Therefore, based on this current record, Petitioner’s position that a person of skill in the art would have combined the teachings of Begemann, Allen, and Krames to reach claim 1’s recited coating is persuasive and supported by evidence.

We next address elements of claim 7, which depends from claim 1. Claim 7 first recites “A device as recited in claim 1 wherein said chip includes a substrate on which epitaxial layers are grown.” Petitioner asserts that Krames teaches an such a substrate. Pet. 41. Based on the current record, we also determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3 (depicting “Sapphire Substrate), 4

(“the two most common substrates used for OMVPE growth of AlGaInN are sapphire and SiC”); *see also* Ex. 1006 ¶¶ 110–111.

Claim 7 next recites “a buffer layer located on said substrate.”

Petitioner asserts that Krames teaches a buffer layer located on its substrate. Pet. 42–43. Based on the current record, we also determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3 (depicting “Buffer Layer”); *see also* Ex. 1006 ¶¶ 112.

Claim 7 next recites “said buffer layer serving to mitigate differences in material properties between said substrate and other epitaxial layers.” Petitioner asserts that Krames’s buffer layer serves this role. Pet. 43–45. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3; Ex. 1006 ¶¶ 113–114; Ex. 1014, 353 (reference Krames cites explaining that mismatch between substrate and film makes film difficult to grow).

Claim 7 next recites “a first cladding layer serving to confine electron movement within the chip.” Petitioner asserts that Krames discloses this layer. Pet. 45–46. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, 5 (referring to GaN confining layers), Fig. 3; Ex. 1006 ¶ 115.

Claim 7 next recites “said first cladding layer being adjacent said buffer layer.” Petitioner asserts that Krames discloses this recitation. Pet. 46. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence as illustrated by Krames Figure 3. Ex. 1008, Fig. 3; Ex. 1006 ¶ 116.

Claim 7 next recites “an active layer.” Petitioner asserts that Krames discloses an active layer. Pet. 46–47. Based on the current record, we

determine that Petitioner's assertion is persuasive and supported by evidence as illustrated by Krames Figure 3. Ex. 1008, Fig. 3; Ex. 1006 ¶ 117.

Claim 7 next recites "said active layer emitting light when electrons jump to a valance state." Petitioner asserts that Krames active layers perform this function. Pet. 47. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1006 ¶ 118.

Claim 7 next recites "a second cladding layer." Pet. 48. Petitioner asserts that Krames teaches this layer. Pet. 48. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Krames 5, Fig. 3; Ex. 1006 ¶ 119.

Claim 7 next recites "said second cladding layer positioned so that said active layer lies between cladding layers." Petitioner asserts that Krames teaches this layer and annotates Krames Figure 3 to illustrate this point. Pet. 48–49. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3; Ex. 1006 ¶ 120.

Claim 7 next recites "a contact layer on which an electron may be mounted for powering said chip." Petitioner asserts that Krames teaches this layer. Pet. 49–50. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3; Ex. 1006 ¶ 122.

We next address elements of claim 8, which depends from claim 7. Claim 8 first recites "[a] device as recited in claim 7 further comprising a first and a second reflective layers." To address this recitation, we first consider claim construction.

In Patent Owner’s district court litigation against Petitioner, Patent Owner contends that the “reflective layer” may be “ITO, SiO₂ or other dielectric.” Ex. 1017, Ex. 6 (“Exemplary Infringement Chart), 22–23. According to Petitioner’s witness, Dr. Lebby, this means that Patent Owner contends that recited “‘reflective layers’ can include transparent or semi-transparent layers that exhibit some reflectivity (e.g., SiO₂) or an interface between two layers (e.g., the buffer and substrate layers) that exhibit differing indexes of refraction.” Ex. 1006 ¶ 72. Dr. Lebby states that he does not agree with Patent Owner’s contention, but he nonetheless contends that ground 1 presents reasons for invalidity that meet Patent Owner’s contention.

Patent Owner notes that the United States District Court for the Central District of California, in litigation not involving Petitioner, previously construed “reflective layers ... serving to reflect light emitted by said active layer” as meaning “distinct layers of material that reflect light emitted by said active layer.” Prelim. Resp. 6. Also, the United States District Court for the District of Delaware construed “a first and a second reflective layers ... serving to reflect light emitted by said active layer” with “the first and second reflective layers are distinct from each other and reflect light emitted by the active layer.” *Id.* at 7. Patent Owner states that the Petition never addresses this claim construction (*id.* at 6, 8) but does not dispute Dr. Lebby’s understanding of Patent Owner’s position in the litigation against Petitioner.

To resolve the issues before us at institution, we accept Dr. Lebby’s understanding of Patent Owner’s position regarding the meaning of the “first and second reflective layers” recitation because Patent Owner does not

dispute this position. Moreover, on the present record, we do not discern inconsistency between this position and the district court claim constructions. To the extent evaluation of the prior art requires further assessment of claim construction of this term, we will resolve those questions based on the full trial record, to the extent necessary, in any final written decision entered in this proceeding. Nothing in this Decision is an invitation for Petitioner to supplement the argument or evidence presented in the Petition with respect to any ground.

Petitioner contends that Krames's "AuNi Contact Layer" is a first reflective layer and Krames's "metal back-reflector" is a second reflective layer. Pet. 50–53. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1008, Fig. 3, 6; Ex. 1006 ¶¶ 123, 124.

Petitioner contends, as an alternative, that the interface between the substrate and the buffer layer is a "second reflective layer." *Id.* at 52. Based on the current record, we determine that Krames discloses an interface between the substrate and the buffer layer. Ex. 1008, Fig. 3, 6; Ex. 1006 ¶ 125. As to whether such an interface meets the claim language, we will, as we explain above, resolve the question, based on the full trial record, to the extent necessary, in any final written decision entered in this proceeding.

Claim 8 next recites "each of said first and second reflective layers being located on opposite sides of said active layer" and "recites said reflective layers serving to reflect light emitted by said active layer." Petitioner's contentions discussed above and reliance on Krames's Figure 3 adequately address these recitations. Pet. 53; *see also* Ex. 1006 ¶ 126.

We next address elements of claim 21 which depends from claim 8. Claim 21 first recites, “the semiconductor light source as recited in claim 8 wherein: said at least one semiconductor chip is a light emitting diode (LED) chip configured to output light at greater than about 40 milliwatts.” Petitioner contends that Krames teaches a LED chip with 170 milliwatt power output (i.e., more than 40 milliwatts). Pet. 53–54. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, 10; Ex. 1006 ¶ 128.

Claim 21 next recites “said LED chip is configured to emit monochromatic visible light.” Pet contends that Krames teaches this recitation. Pet. 54. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1008, 50; Ex. 1006 ¶ 129.

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Begemann, Krames, and Allen teaches or reasonably suggests all of the elements of claim 21. We are also persuaded that a person of ordinary skill in the art would have had a reason to combine these references’ teachings to reach claim 21 with a reasonable expectation of success. Thus, we are persuaded that Petitioner has sufficiently established a reasonable likelihood of establishing that this combination of references renders claim 21 obvious.

- b. *Dependent Claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91*

Petitioner accounts for the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81,

82, 85, 86, and 88–91. Pet. 54–104. Petitioner provides detailed explanations as to how the combination of Begemann, Krames, and Allen teaches or reasonably suggests the limitations of these claims, citing Michael S. Lebby’s testimony for support. *Id.* (citing Ex. 1006).

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Begemann, Krames, and Allen teaches or reasonably suggests all of the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91. Having reviewed Petitioner’s arguments and supporting evidence in the present record, which Patent Owner does not dispute at this time, we are persuaded that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable as obvious over the combination of Begemann, Krames, and Allen.

2. *Unpatentability over Begemann, Nakamura, Allen, and Krames*

Petitioner asserts that claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable under 35 U.S.C. § 103(a) as obvious over Begemann, Nakamura, Allen, and Krames, citing the Declaration of Dr. Michael S. Lebby for support. Pet. 104–116 (citing Ex. 1006). We have reviewed Petitioner’s arguments and evidence and have found them to be sufficient to meet the threshold of § 314(a). Patent Owner does not persuasively dispute

Petitioner's positions. Below, we address claim 21 while addressing dependent claims collectively.

a. *Claim 21*

Claim 21 depends from cancelled claims 1, 7, and 8. For claim 1 elements, Petitioner refers to its Ground 1 contentions. Pet. 104. We, likewise, refer to our analysis of claim 1 above.

We next address elements of claim 7 which depends from claim 1. Claim 7 recites “[a] device as recited in claim 1 wherein said chip includes a substrate on which epitaxial layers are grown.” Petitioner contends that Nakamura teaches such a chip and refers to Nakamura Figure 11. Pet. 104–105. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, Fig. 11, 19:46; Ex. 1006 ¶ 227.

Petitioner also asserts that a person of skill in the art would have had reason to combine the teachings of Nakamura, Allen, and Krames with Begemann. Pet. 27–32. Based on the current record, we also determine that Petitioner's assertion is persuasive and supported by evidence. Begemann teaches the use of LED chips for its LED lamp, but it does not describe the details of its LED chips. Ex. 1007, 1:1–4, 4:21–22. A person of ordinary skill in the art seeking to implement Begemann's teachings would have looked to other references, such as Nakamura, Krames, and Allen, to learn more about the structure of high-power LED chips. Ex. 1006 ¶¶ 91–94.

We address Krames and Allen above. Nakamura teaches an LED chip structure meant to achieve luminous output. Ex. 1006 ¶ 94; *see also* Pet. 25; Ex. 1009, 1:7–11; 2:33–35. On the present record, Petitioner adequately establishes that a person of ordinary skill in the art would have reason to

implement Nakamura's chip design while increasing area and operating current as taught by Krames to meet Begemann's goals. Pet. 30; Ex. 1007, 2:3–5; Ex. 1006 ¶ 94.

Claim 7 recites “a buffer layer located on said substrate.” Petitioner contends that Nakamura teaches such a layer. Pet. 105. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 19:47, Fig. 11; Ex. 1006 ¶ 228.

Claim 7 recites “said buffer layer serving to mitigate differences in material properties between said substrate and other epitaxial layers.” Petition argues that Nakamura's buffer layer meets this function. Pet. 105–106. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 19:47–49, Fig. 11; Ex. 1006 ¶ 229.

Claim 7 recites “a first cladding layer serving to confine electron movement within the chip.” Petitioner contends that Nakamura teaches such a cladding layer. Pet. 106–107. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 19:50, Fig. 11; Ex. 1006 ¶¶ 230–231.

Claim 7 recites “said first cladding layer being adjacent said buffer layer.” Petitioner contends that Nakamura teaches this configuration. Pet. 107–108. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, Fig. 11; Ex. 1006 ¶¶ 232–233.

Claim 7 recites “an active layer.” Petitioner contends that Nakamura teaches this configuration by annotated Nakamura Figure 11. Pet. 109. Based on the current record, we determine that Petitioner's assertion is

persuasive and supported by evidence. Ex. 1009, Nakamura 19:51 (“active layer 156”), Fig. 11; Ex. 1006 ¶ 234.

Claim 7 recites “said active layer emitting light when electrons jump to a valance state.” Petitioner contends that Nakamura’s active layer performs this function. Pet. 109. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1006 ¶ 235.

Claim 7 recites “a second cladding layer.” Petitioner asserts that Nakamura discloses this layer “as p-type clad layer 158.” Pet. 109–110. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1009, Fig. 11, 19:52; Ex. 1006 ¶ 236.

Claim 7 recites “said second cladding layer positioned so that said active layer lies between cladding layers.” Petitioner annotates Nakamura Figure 11 to illustrate how Nakamura teaches this recitation. Pet. 110–111. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1009, Fig. 11; Ex. 1006 ¶ 237.

Claim 7 recites “a contact layer on which an electron may be mounted for powering said chip.” Petitioner asserts that Nakamura discloses this layer as p-type contact layer 159. Pet. 111–112. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1009, 19:52–53, Fig. 11; Ex. 1006 ¶ 238.

We next address elements of claim 8 which depends from claim 7. Claim 8 first recites “[a] device as recited in claim 7 further comprising a first and a second reflective layers.” We address claim construction with regard to this recitation above.

Petitioner asserts that Nakamura's seventh embodiment discloses these layers as "(1) first multi-layered film 100, not depicted in Figure 11 but described as being on the outer side of the first n-type clad layer 155, and (2) second multi-layered film 100, not depicted in Figure 11 but described as being on the outer side of the second p-type clad layer 158." Pet. 112–114. Petitioner also annotates Nakamura Figure 11 to illustrate these two layers. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 19:43–45, 21:47–55, Fig. 11; Ex. 1006 ¶¶ 239–240.

Claim 8 next recites "each of said first and second reflective layers being located on opposite sides of said active layer." Petitioner annotates Nakamura Figure 11 to show how this recitation is met. Pet. 114–115. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 21:47–55, Fig. 11; Ex. 1006 ¶ 241.

Claim 8 next recites "said reflective layers serving to reflect light emitted by said active layer." Petitioner asserts that Nakamura's layers will meet this function. Pet. 115. Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1009, 21:48–49; Ex. 1006 ¶ 241–242.

We next address elements of claim 21 which depends from claim 8. With respect to recitations of claim 21, Petitioner refers back to its ground 1 assertions and assertions regarding combining Nakamura and claims. We, likewise, refer to our analysis above in this regard.

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Begemann, Nakamura, Allen, and Krames teaches or

reasonably suggests all of the elements of claim 21. We are also persuaded that a person of ordinary skill in the art would have had a reason to combine these references' teachings to reach claim 21 with a reasonable expectation of success. Thus, we are persuaded that Petitioner has sufficiently established a reasonable likelihood of establishing that this combination of references renders claim 21 obvious. Patent Owner does not persuasively dispute Petitioner's position.

- b. *Dependent Claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91*

Petitioner accounts for the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 by citing the arguments they set forth for their first ground. Pet. 116.

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Begemann, Nakamura, Allen, and Krames teaches or reasonably suggests all of the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91. Having reviewed Petitioner's arguments and supporting evidence in the present record, we are persuaded that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable as obvious over the combination of Begemann, Nakamura, Allen, and Krames. Patent Owner does not persuasively dispute Petitioner's position.

3. *Unpatentability over Begemann, Sugiura, Allen, and Krames*

Petitioner asserts that claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable under 35 U.S.C. § 103(a) as unpatentable over Begemann, Sugiura, Allen, and Krames, citing the Declaration of Dr. Michael S. Lebby for support. Pet. 116–130 (citing Ex. 1006). We have reviewed Petitioner’s arguments and evidence and have found them to be sufficient to meet the threshold of § 314(a). Patent Owner does not persuasively dispute Petitioner’s positions. Below, we address claim 21 while addressing dependent claims collectively.

a. *Claim 21*

Claim 21 depends from cancelled claims 1, 7, and 8. For claim 1 elements, Petitioner refers to its Ground 1 contentions. Pet. 116. We, likewise, refer to our analysis of claim 1 above.

We next address elements of claim 7 which depends from claim 1. Claim 7 recites “[a] device as recited in claim 1 wherein said chip includes a substrate on which epitaxial layers are grown.” Petitioner contends that Sugiura teaches such a chip and refers to Sugiura Figure 7. Pet. 116–117. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 228.

Petitioner also asserts that a person of skill in the art would have had reason to combine the teachings of Sugiura, Nakamura, Allen, and Krames with Begemann. Pet. 27–32. Based on the current record, we also determine that Petitioner’s assertion is persuasive and supported by evidence. Begemann teaches the use of LED chips for its LED lamp, but it does not

describe the details of its LED chips. Ex. 1007, 1:1–4, 4:21–22. A person of ordinary skill in the art seeking to implement Begemann’s teachings would have looked to other references, such as Sugiura, Krames, and Allen, to learn more about the structure of high-power LED chips. Ex. 1006 ¶¶ 91–94.

We address Krames and Allen above. Sugiura teaches a LED chip structure meant to achieve luminous output. Ex. 1006 ¶ 94; *see also* Pet. 24–25; Ex. 1010, 1:6–9, 6:4–13. On the present record, Petitioner adequately establishes that a person of ordinary skill in the art would have reason to implement Sugiura’s chip design while increasing area and operating current as taught by Krames to meet Begemann’s goals. Pet. 30; Ex. 1007, 2:3–5; Ex. 1006 ¶ 94.

Claim 7 next recites “a buffer layer located on said substrate.” Petitioner asserts that Sugiura layers 32 and 33 are a buffer layer. Pet. 117–118. , Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 249.

Claim 7 next recites “said buffer layer serving to mitigate differences in material properties between said substrate and other epitaxial layers.” Petitioner asserts that Sugiura teaches that its buffer layer has this property. Pet. 118. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, 1:31–36; Ex. 1006 ¶ 250.

Claim 7 next recites “a first cladding layer serving to confine electron movement within the chip.” Petitioner asserts that Sugiura discloses this layer as n-type AlGaIn current injection layer 36. Pet. 118–119. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 251.

Claim 7 next recites “said first cladding layer being adjacent said buffer layer.” Petitioner asserts that Sugiura Figure 3 illustrates this arrangement. Pet. 119–122. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶¶ 252–253; Ex. 1003, 23.

Claim 7 next recites “an active layer.” Petitioner asserts that Sugiura Figure 7 shows InGaN active layer 38. Pet. 122–123. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 254.

Claim 7 recites “said active layer emitting light when electrons jump to a valance state.” Petitioner asserts that Sugiura’s active layer will perform this function. Pet. 123. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1006 ¶ 255.

Claim 7 recites “a second cladding layer.” Petitioner asserts that Sugiura layer 40 meets this recitation. Pet. 123–124. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 256.

Claim 7 recites “said second cladding layer positioned so that said active layer lies between cladding layers.” Petitioner asserts that Sugiura Figure 7 illustrates this arrangement. Pet. 124–125. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 257.

Claim 7 recites “a contact layer on which an electron may be mounted for powering said chip.” Petitioner asserts that Sugiura layer 41 is such a contact layer. Pet. 125–126. Based on the current record, we determine that

Petitioner's assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶ 258.

We next address elements of claim 8 which depends from claim 7. Claim 8 recites, “[a] device as recited in claim 7 further comprising a first and a second reflective layers.” We address claim construction of this recitation above.

Petitioner asserts that Sugiura Figure 7 discloses a first reflective layer as film 43. Pet. 126–127. Petitioner asserts that it would have been obvious to a person having ordinary skill in the art to also include a metal back reflector attached to and beneath the sapphire substrate as a second reflective layer “to prevent light from being absorbed by the mounting surface.” *Id.* at 127. Petitioner asserts that Krames teaches using such a layer. *Id.* Based on the current record, we determine that Petitioner's assertion is persuasive and supported by evidence. Ex. 1010, Fig. 7; Ex. 1006 ¶¶ 259–261; *see also* discussion of Krames above.

As an alternative, Petitioner asserts that Sugiura discloses a second reflective layer “as the interface between the substrate (layer 30) and the buffer layer (combination of layers 32 and 33).” Pet. 128. Based on the current record, we determine that this Sugiura discloses such an interface. Ex. 1010, Fig. 7, 6; Ex. 1006 ¶ 271. As to whether such an interface meets the claim language, we will, as we explain above, resolve the question, based on the full trial record, to the extent necessary, in any final written decision entered in this proceeding.

Claim 8 also recites “each of said first and second reflective layers being located on opposite sides of said active layer” and “said reflective layers serving to reflect light emitted by said active layer.” Petitioner asserts

that these recitations are met by referring to annotated Sugiura Figure 7. Pet. 128–129. Petitioner’s contentions discussed above and reliance on Sugiura Figure 7 adequately address these recitations. *See also* Ex. 1006 ¶ 262.

We next address elements of claim 21 which depends from claim 8. Claim 21 first recites, “the semiconductor light source as recited in claim 8 wherein: said at least one semiconductor chip is a light emitting diode (LED) chip configured to output light at greater than about 40 milliwatts.” Petitioner contends that Sugiura in combination with Krames discloses this recitation. Pet. 129–130. Based on the current record, we determine that Petitioner’s assertion is persuasive and supported by evidence. *See* discussion of Krames, above; Ex. 1008, 10; Ex. 1006 ¶¶ 128, 264.

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Sugiura, Begemann, Krames, and Allen teaches or reasonably suggests all of the elements of claim 21. We are also persuaded that a person of ordinary skill in the art would have had a reason to combine these references’ teachings to reach claim 21 with a reasonable expectation of success. Thus, we are persuaded that Petitioner has sufficiently established a reasonable likelihood of establishing that this combination of references renders claim 21 obvious. Patent Owner does not persuasively dispute Petitioner’s position.

- b. *Dependent Claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91*

Petitioner accounts for the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81,

82, 85, 86, and 88–91 by citing the arguments they set forth for their first ground. Pet. 130.

Based on the evidence in this present record, we are persuaded that Petitioner has shown sufficiently for purposes of this Decision that the combination of Begemann, Sugiura, Allen, and Krames teaches or reasonably suggests all of the limitations recited in claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91. Having reviewed Petitioner’s arguments and supporting evidence in the present record, we are persuaded that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 are unpatentable as obvious over the combination of Begemann, Sugiura, Allen, and Krames. Patent Owner does not persuasively dispute Petitioner’s position.

IV. CONCLUSION

For the reasons above, we determine that the information presented in the Petition establishes that there is a reasonable likelihood that Petitioner would prevail with respect to challenged claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59, 62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 of the ’961 patent. At this juncture in the proceeding, we have not made a final determination with respect to the patentability of the challenged claims, or with respect to claim construction.

V. ORDER

For the foregoing reasons, it is

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 21, 22, 25, 26, 28–30, 32–36, 40–44, 47–49, 52, 53, 56–59,

62, 63, 65–68, 71–73, 77, 78, 81, 82, 85, 86, and 88–91 of the '961 patent is hereby instituted with respect to the ground of unpatentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial will commence on the entry date of this Decision.

IPR2022-00847
Patent 6,465,961 C2

PETITIONER:

John Alemanni
Matias Ferrario
KILPATRICK TOWNSEND & STOCKTON LLP
jalemanni@kilpatricktownsend.com
mferrario@kilpatricktownsend.com

PATENT OWNER:

Joshua Larsen
Paul Hunt
Adam Kaufmann
BARNES & THORNBURG LLP
Joshua.larsen@btlaw.com
Paul.hunt@btlaw.com
Adam.kaufmann@btlaw.com