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571-272-7822

Paper 13
Entered: November 8, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SATCO PRODUCTS, INC.,
Petitioner,

v.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA,
Patent Owner.

IPR2021-00662
Patent 10,644,213 B1

Before JENNIFER S. BISK, CHRISTOPHER L. CRUMBLEY, and STEVEN M. AMUNDSON, *Administrative Patent Judges*.

BISK, *Administrative Patent Judge*.

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

I. INTRODUCTION

Satco Products, Inc., filed a Petition requesting an *inter partes* review of claims 1 and 2 ("the challenged claims") of U.S. Patent No. 10,644,213 B1 (Ex. 1003, "the '213 patent"). Paper 2 ("Pet"). The owner of the '213 patent, Regents of the University of California, filed a Preliminary Response. Paper 9 ("Prelim. Resp.").

Under 37 C.F.R. § 42.4(a), we have authority to determine whether to institute an *inter partes* review. We may institute an *inter partes* review only if "the information presented in the petition filed under section 311 and any response filed under section 313 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." 35 U.S.C. § 314(a) (2018).

Based on the current record and for the reasons explained below, Petitioner has shown that there is a reasonable likelihood that it would prevail with respect to at least one of the challenged claims. Patent Owner has not persuaded us to exercise our discretion to deny institution. Thus, we institute an *inter partes* review of claims 1 and 2 in the '213 patent on all challenges presented.

II. BACKGROUND

A. Real Parties in Interest

Petitioner identifies itself as the real party in interest. Pet. 2. Patent Owner identifies itself as the real party in interest. Paper 4, 2. The parties do not raise any issue about real parties in interest.

B. Related Matters

The parties identify several related district court cases, including *Satco Products, Inc. v. The Regents of the University of California*, 2:19-cv-

06444 in the Eastern District of New York ("the Satco Litigation"). Pet. 2–3; Paper 4, 2–3. In addition, there are several other pending or terminated IPR proceedings challenging patents related to the '213 patent, including IPR2020-00579, IPR2020-00695, IPR2020-00780, IPR2021-00661, and IPR2021-00794.

C. The '213 Patent

The '213 patent, titled "Filament LED Light Bulb," issued on May 5, 2020, from an application filed on September 11, 2019. Ex. 1003, codes (22), (45), (54). The patent identifies that application as the last in a series of continuation applications that started with application no. 11/954,154 ("the '154 application"), filed on December 11, 2007. *Id.* at 1:7–42, code (63). Further, the patent claims priority to provisional application no. 60/869,447 ("the '447 provisional"), filed on December 11, 2006. *Id.* at 1:43–46, code (60). The '213 patent incorporates by reference several patent applications (*see id.* at 1:43–7:66), including provisional application no. 60/869,454 ("the '454 provisional"), filed on December 11, 2006. *Id.* at 7:16–23.

The '213 patent explains that "[i]n conventional LEDs, in order to increase the light output power from the front side of the LED, the emitt[ed] light is reflected by the mirror on the backside of the sapphire substrate or the mirror coating on the lead frame." Ex. 1003, 10:49–52; *see id.* at 8:16–21. But an LED's emitting layer (active region) may reabsorb reflected light because the photon energy in the light "is almost [the] same as the band-gap energy" of the LED's emitting layer. *Id.* at 10:55–57; *see id.* at 8:22–25. Reabsorption by the LED's emitting layer decreases the LED's "efficiency or output power." *Id.* at 10:58–60; *see id.* at 8:25–28.

To address that deficiency, the '213 patent discloses minimizing internal reflections within an LED by eliminating mirrors and/or mirrored surfaces, and minimizing reabsorption of light by the active region. Ex. 1003, 8:67–9:3. The patent explains that the invention concerns "a light emitting device comprised of a plurality of III-nitride layers" with "an active region that emits light, wherein all of the layers except for the active region are transparent for an emission wavelength of the light, such that the light is extracted effectively through all of the layers and in multiple directions through the layers." *Id.* at 8:39–45, 11:35–42, code (57). The patent discloses a lead frame supporting a transparent plate and the III-nitride layers residing on the transparent plate, such that "the light emitted from the III-nitride layers is transmitted through the transparent plate in the lead frame." *Id.* at 8:59–61. The patent also discloses several LED structures "according to the preferred embodiment of the present invention." *See, e.g.*, *id.* at 9:32–10:21, Figs. 4–22.

Figures 8A and 8B in the ’213 patent (reproduced below) depict an LED structure “according to the preferred embodiment of the present invention”:

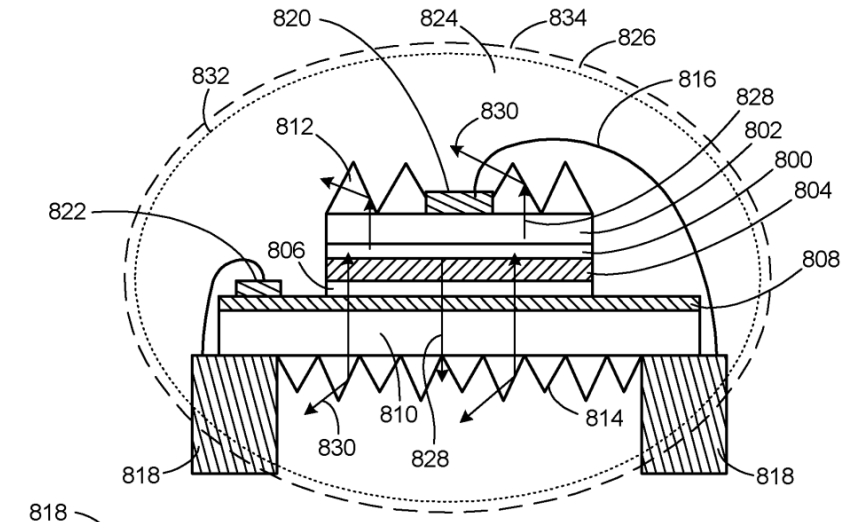


FIG. 8A

FIG. 8B

Figures 8A and 8B illustrate an LED including “an emitting layer 800, an n-type GaN [gallium nitride] layer 802, a p-type GaN layer 804, a first ITO [indium tin oxide] layer 806, a second ITO layer 808, and a glass layer 810.” Ex. 1003, 13:50–55, Figs. 8A–8B; *see id.* at 9:44–46. The LED “is wire bonded 816 to a lead frame or sub-mount 818 using the bonding pads 820, 822.” *Id.* at 13:59–61, Fig. 8A. Figure 8B shows a top view of “the lead frame 818.” *Id.* at 14:19–20, Fig. 8B.

“The n-type GaN layer 802 has a surface 812 that is roughened, textured, patterned or shaped (e.g., a cone shape surface), and the glass layer 810 has a surface 814 that is roughened, textured, patterned or shaped (e.g., a cone shape surface).” Ex. 1003, 13:55–57, Fig. 8A. A roughened,

textured, patterned, or shaped surface enhances light extraction. *Id.* at 8:45–47, 9:10–12, 11:42–44, code (57).

Figure 8A shows the LED embedded in spherically shaped optical element 824 "made of epoxy or glass, forming, for example, a lens." Ex. 1003, 13:33–34, 13:62–64, Fig. 8A. "The shaped optical element 824 may include a phosphor layer 826, which may be remote from the LED, that is roughened, textured, patterned or shaped, for example, on an outer surface of the shaped optical element 824." *Id.* at 13:64–14:1. Placing phosphor layer 826 on or near the outer surface of shaped optical element 824 increases the conversion efficiency of blue light to white light by reducing the reabsorption of back-scattered light, i.e., light scattered by phosphor layer 826. *Id.* at 14:11–16. Further, "if the surface 834 of the phosphor layer 826 is roughened, textured, patterned or shaped, light extraction is again increased." *Id.* at 14:16–18.

Figures 10A and 10B in the ’213 patent (reproduced below) depict an LED structure “according to the preferred embodiment of the present invention”:

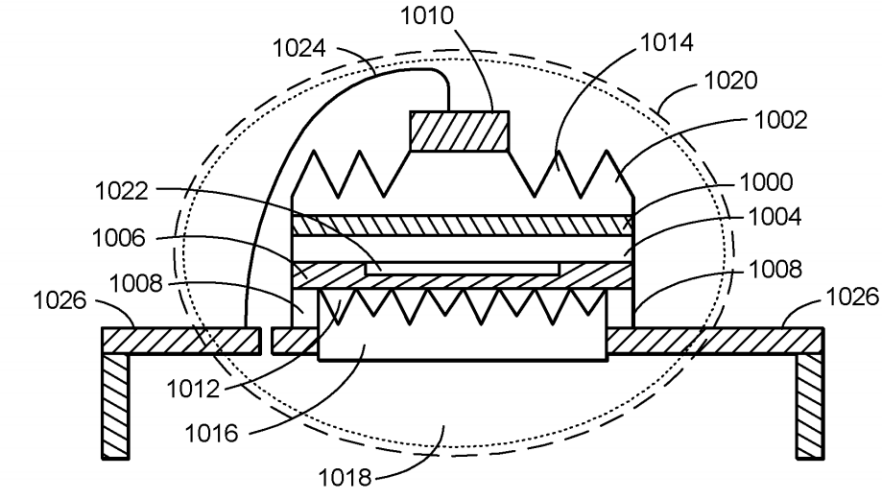


FIG. 10A

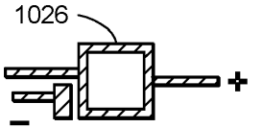


FIG. 10B

Figures 10A and 10B illustrate an LED including “an InGaN [indium gallium nitride] MQW [multiple quantum well] emitting layer 1000, an n-type GaN layer 1002, a p-type GaN layer 1004, an ITO layer 1006, a bonding pad 1008, an ohmic contact/bonding pad 1010,” and “a current spreading layer 1022.” Ex. 1003, 14:46–53, 14:61–62, Figs. 10A–10B; *see id.* at 9:50–52. The LED “is wire bonded 1024 to a lead frame 1026.” *Id.* at 15:4–5, Fig. 10A. Figure 10B “shows a top view of the lead frame 1026.” *Id.* at 14:67, Fig. 10B.

Surface 1012 of ITO layer 1006 “is roughened, textured, patterned or shaped,” and epoxy layer 1016 “is deposited on the surface 1012.” Ex. 1003, 14:49–54, Fig. 10A. Surface 1014 of n-type GaN layer 1002 “is roughened, textured, patterned or shaped.” *Id.* at 14:50–54, Fig. 10A.

Figure 10A shows the LED embedded in spherically shaped optical element 1018 "made of epoxy or glass, forming, for example, a lens." Ex. 1003, 14:54–56, Fig. 10A. "The shaped optical element 1018 may include a phosphor layer 1020, which may be remote from the LED, that is roughened, textured, patterned or shaped, for example, on an outer surface of the shaped optical element 1018." *Id.* at 14:56–60.

Figures 22A and 22B in the '557 patent (reproduced below) depict an LED structure "according to the preferred embodiment of the present invention":

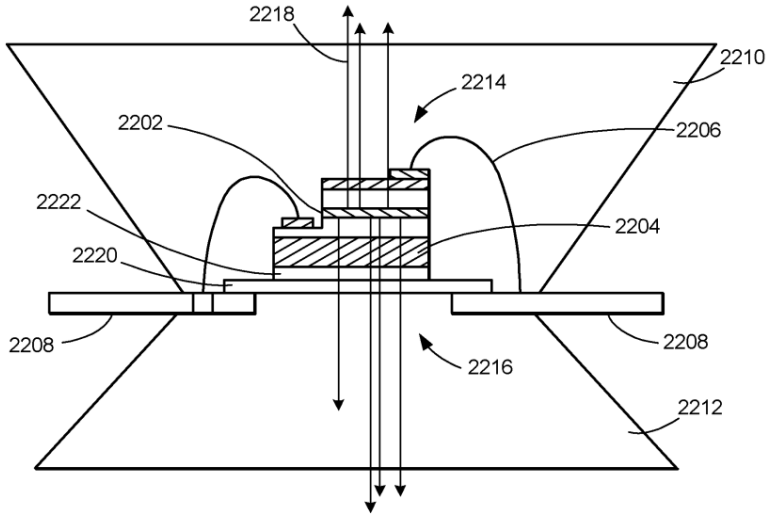


FIG. 22A

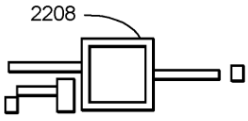


FIG. 22B

Figures 22A and 22B illustrate an LED including "an emitting layer 2202 and a substrate 2204 (as well as other layers)." Ex. 1003, 20:14–19, Figs. 22A–22B; *see id.* at 10:19–21. The LED "is wire bonded 2206 to a

lead frame 2208." *Id.* at 20:19–21, Fig. 22A. Figure 22B "shows a top view of the lead frame 2208." *Id.* at 20:20–21, Fig. 22B.

Figure 22A shows the LED "embedded in or combined with moldings or shaped optical elements 2210, 2212, such as inverted cone shapes made of epoxy or glass, forming, for example, lenses." Ex. 1003, 20:22–25, Fig. 22A. The "shaped optical elements 2210, 2212 are formed on opposite sides, e.g., the top/front side 2214 and bottom/back side 2216 of the LED 2200, wherein the emitting layer 2200 emits light 2218 that is extracted from both the top/front side 2214 and bottom/back side 2216 of the LED 2200." *Id.* at 20:25–31.

"The lead frame 2208 includes a transparent plate 2220." Ex. 1003, 20:32, Fig. 22A. "The transparent plate 2220 may be comprised of glass, quartz, sapphire, diamond or other material transparent for the desired emission wavelength" so that "the transparent glass plate 2220 effectively extracts the light 2218 emitted from" the LED "to the shaped optical element 2212." *Id.* at 20:34–40. The LED "is bonded to the transparent plate 2220 using a transparent/clear epoxy 2222 as a die-bonding material." *Id.* at 20:32–34, Fig. 22A.

D. The Challenged Claims

Petitioner challenges claims 1 and 2 in the '213 patent, i.e., every claim in the patent. *See* Pet. 6, 38–89. The challenged claims read as follows:

> 1. A light bulb, comprising at least one light emitting device, the at least one light emitting device each further comprising:
>
> a sapphire plate, a cathode on a first end of the sapphire plate and an anode on a second end of the sapphire plate,

wherein the cathode and anode provide structural support to the sapphire plate and are adapted to provide an electrical connection between the light emitting device and a structure outside the light emitting device;

at least one III-nitride light emitting diode (LED) comprising a sapphire growth substrate, the sapphire growth substrate in mechanical communication with the sapphire plate, and the LED and sapphire plate configured to extract light emitted by the LED through the sapphire plate; and

a molding comprising a phosphor and surrounding the LED, the molding configured to extract light from both a front side of the light emitting device and a back side of the light emitting device.

2. The light bulb of claim 1, wherein the sapphire growth substrate is a patterned sapphire substrate (PSS).

Ex. 1003, 21:15–22:17.

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claims Challenged	35 U.S.C. §[1]	Basis
1, 2	103(a)	Nakamura-959[2], Nakamura-949[3]
1	102	Tanda[4]
1	103(a)	Yamazaki[5], Schubert[6]
1	103(a)	Yamazaki, Schubert, Uemura[7,8]

[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), included revisions to 35 U.S.C. §§ 102 and 103 that became effective on March 16, 2013. Because the '213 patent issued from an application that was a continuation of an application filed before March 16, 2013, and Petitioner has not persuaded us that, for purposes of this Decision, the claims of the '213 patent are not entitled to that priority date, we apply the pre-AIA version of the statutory bases for unpatentability.

[2] U.S. Patent App. Pub. No. US 2008/0149959 A1 (published June 26, 2008). Ex. 1004.

[3] U.S. Patent App. Pub. No. US 2008/0149949 A1 (published June 26, 2008). Ex. 1005.

[4] U.S. Patent App. Pub. No. US 2007/0139949 A1 (published June 21, 2007). Ex. 1006.

[5] Japan Patent App. Pub. No. 2003-249692A (published Sept. 5, 2003). Ex. 1007 (certified English translation pages 7–13).

[6] E. Fred Schubert, *Light-Emitting Diodes*, 1st ed. New York: Cambridge University Press, 2003. Ex. 1008.

[7] U.S. Patent No. 6,310,364 B1 (issued Oct. 30, 2001). Ex. 1009.

[8] Petitioner styles as one ground "Ground 3 [obviousness over Yamazaki and Schubert], further in view of any one of Uemura (Ex-1009), Han (Ex-1010), or Feldman (Ex-1011), renders obvious claim 1." Pet. 6. Because there are

Claims Challenged	35 U.S.C. §[1]	Basis
1	103(a)	Yamazaki, Schubert, Han[9]
1	103(a)	Yamazaki, Schubert, Feldman[10]
2	103(a)	Tanda, Tadatomo[11,12]
2	103(a)	Yamazaki, Schubert, Tadatomo
2	103(a)	Yamazaki, Schubert, Uemura, Tadatomo
2	103(a)	Yamazaki, Schubert, Han, Tadatomo
2	103(a)	Yamazaki, Schubert, Feldman, Tadatomo

three separate combinations of references, we enter these combinations into our table as three separate grounds.

[9] Korean Registered Patent No. 10-0626365 B1 (published Sept. 20, 2006). Ex. 1010 (certified English translation pages 10–20).

[10] U.S. Patent No. 6,666,567 B1 (issued Dec. 23, 2003). Ex. 1011.

[11] Tadatomo, K. et al. "High Output Power Near-Ultraviolet and Violet Light-Emitting Diodes Fabricated on Patterned Sapphire Substrates Using Metalorganic Vapor Phase Epitaxy." Proceedings of SPIE – the International Society for Optical Engineering, vol. 5187, Third International Conference on Solid State Lighting, (26 January 2004): 243–249. Bellingham, WA: SPIE, c2004. Ex. 1012.

[12] Petitioner styles as one ground "Ground 2, 3, and 4, further in view of Tadatomo (Ex-1012), renders obvious claim 1." Pet. 6. Because this ground adds Tadatomo to five combinations of references, we enter these combinations into our table as five separate grounds.

Pet. 6, 38–89. Petitioner submits the Declaration of Russell D. Dupuis, Ph.D. (Ex. 1035) in support of its arguments.

F. Effective Filing Date

The parties disagree on the proper effective filing date for the claims of the '213 patent. On its face, the '213 patent claims priority to "a string of continuation applications stretching back to" the original '154 application, filed December 11, 2007. Prelim. Resp. 12; Ex. 1003, code (63). The '213 patent also claims priority to the '447 provisional, filed December 11, 2006. Ex. 1003, code (60). Patent Owner asserts that claims 1 and 2 of the '213 patent are entitled to an effective filing date of December 11, 2006. *See* Prelim. Resp. 1, 11–13. Petitioner asserts that "the '213 patent is not entitled to an effective filing date prior to its actual filing date of September 11, 2019." Pet. 7, 12–22.

If the effective filing date is, as proposed by Patent Owner, December 11, 2006, several of Petitioner's asserted references, namely Nakamura-959, Nakamura-949, and Tanda, would not qualify as prior art.[13] *See* Ex. 1004 (published June 26, 2008); Ex. 1005 (published June 26, 2008); Ex. 1006 (filed Dec. 14, 2006). In addition, because the Leahy-Smith America Invents Act, Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013, Patent Owner's proposed date would result in application of the pre-

[13] Petitioner states that Tanda (alleged to anticipate claim 1 in Ground 2 in the Petition) qualifies as prior art "regardless of whether the AIA or pre-AIA statutory scheme applies" (Pet. 7) and "is prior art under pre-AIA §§ 102(a) and (e)" (*id.* at 62). However, Tanda's filing date of December 14, 2006, is *after* December 11, 2006, and, therefore, would not qualify as prior art under either pre-AIA §§ 102(a) and (e) under Patent Owner's asserted filing date.

AIA version of the statutory bases for unpatentability, while Petitioner's proposed date would result in application of the post-AIA version.

The dispute over effective filing date centers on claim 1's limitation "a cathode on a first end of the sapphire plate and an anode on a second end of the sapphire plate, wherein the cathode and anode provide structural support to the sapphire plate" ("the cathode/anode limitation"). Pet. 12–22; Prelim. Resp. 12–25. In particular, Petitioner contends that the '213 patent "does not disclose any embodiment in which a cathode and an anode are on ends of a transparent plate or in which a cathode and an anode both 'provide structural support' to the plate." Pet. 13 (emphasis omitted). Petitioner also contends that the "figures also do not disclose the cathode/anode limitation" because "[i]n every figure of the '213 patent depicting a lead frame with leads on either side of a transparent plate, only one lead structurally supports the plate." *Id.* (emphases omitted); *see id.* at 13–14.

Further, Petitioner argues that Rule 1.57 precludes Patent Owner from relying on the incorporated-by-reference '454 provisional as support for the cathode/anode limitation. *See* Pet. 1, 16–22. Rule 1.57 provides as follows: "'Essential material' may be incorporated by reference, but only by way of an incorporation by reference to a U.S. patent or U.S. patent application publication, which patent or patent application publication does not itself incorporate such essential material by reference." 37 C.F.R. § 1.57(d). Rule 1.57 defines "Essential material" as "material that is necessary to" support a claimed invention according to § 112's first paragraph. *Id.* Petitioner argues that the incorporated-by-reference '454 provisional is not "a U.S. patent or U.S. patent application publication" as specified in

Rule 1.57, and thus cannot support the cathode/anode limitation according to § 112's first paragraph. *See* Pet. 1, 21–22.

1. The Prosecution History

The cathode/anode limitation also appeared in the '213 patent's parent application—U.S. Patent Application No. 16/422,323 ("the parent '323 application"). Ex. 1025, 63:4–7. The Examiner issued several rejections based on this limitation, including that it was not entitled to priority to the original '154 application or the '447 provisional because these applications did not disclose the cathode/anode limitation. *Id.* at 115–116. The Examiner rejected claims 1 and 2 under § 112 for failing to comply with the written-description requirement. *Id.* at 117–18. Additionally, the Examiner initialed as considered the references listed in the May 2019 information disclosure statements, including Nakamura-959 (*id.* at 130), Nakamura-949 (*id.* at 130, 145), Tanda (*id.* at 145), Yamazaki (*id.* at 131), Uemura (*id.* at 125), and Han (*id.* at 132).

In July 2019, Patent Owner conducted a telephonic interview with the Examiner. Ex. 1025, 165. Before the interview, Patent Owner submitted an agenda for the interview that included arguments about the Examiner's priority determination and the § 112 rejection. *Id.* at 167–69. In the agenda, Patent Owner argued that the '447 provisional filed on December 11, 2006, supports the disputed limitation, e.g., in Figure 22. *Id.* at 167–68. Patent Owner also argued that the '454 provisional filed on December 11, 2006, supports the disputed limitation, e.g., in Figure 5. *Id.* at 168–69. The parent '323 application (1) claims priority to the '447 provisional and (2) incorporates by reference the '447 provisional and the '454 provisional. *Id.* at 10, 31, 41–42, 107.

Subsequently, the Examiner summarized the July 9, 2019, interview stating that "[a]pplicant['s] representative pointed to Figure 22A of the specification" and similar Figure 22 of the '447 provisional as sufficient to show the cathode/anode limitation. Ex. 1025, 165. The Examiner added that "[a]pplicant is suggested to amend the specification to add the claim 1 language of 'cathode and anode' in the description of Fig. 22A to make the specification consistent with claim 1 without introducing any new matter," noting that "[t]hese remarks would overcome the rejections of record." *Id.*

On the same day as the interview, Patent Owner made the Examiner's suggested amendment to the specification, and in attached remarks stated "[t]he specification has been amended to include additional details as to an embodiment of the present invention illustrated in FIGS. 22A and 22B, support for which can be found at least at: (1) FIGS. 22A and 22B as originally filed, (2) FIG. 22 of [the '447 provisional], and (3) FIG. 5 of [the '454 incorporated provisional], which was incorporated by reference in the present application. No new matter is added." *Id.* at 162. Specifically, Patent Owner added the following language to the description of Figures 22A and 22B:

> In an embodiment of the present invention, FIGS. 22A and 22B illustrate a sapphire plate, a cathode on a first end of the sapphire plate and an anode on a second end of the sapphire plate, wherein the cathode and anode provide structural support to the sapphire plate and are adapted to provide an electrical connection between the light emitting device and a structure outside the light emitting device.

Id. at 163. The amendment did not change claims 1 and 2. *Id.* at 159, 162–63. Based on the amendment to the specification, Patent Owner requested reconsideration and withdrawal of the § 112 rejection. *Id.* Further, Patent

Owner argued that claims 1 and 2 "are entitled to the benefit of priority" to the '447 provisional. *Id.*

In September 2019, the Examiner allowed claims 1 and 2 and stated that the reason for allowance was "remarks filed 7/9/19." *Id.* at 175. The '323 parent application issued as Patent No. 10,454,010 B1 on October 22, 2019 ("the '010 patent").

In September 2019, Patent Owner filed the application that issued as the '213 patent. *See* Ex. 1023, 41–104. The application included claims 1 and 2 as they appear in the patent. *Id.* at 73; Ex. 1003, 21:15–22:17. In examining the '213 patent, no rejections were issued related to the cathode/anode limitation. *See* Ex. 1023, 115–119 (Non-Final Office Action), 1912–1915 (Final Office Action). It was examined "under the pre-AIA first to invent provisions." *Id.* at 117.

2. Arguments

The parties appear to agree that, in allowing the claims of the '323 parent application, the Examiner concluded that the two issued claims of the '010 patent, which include the cathode/anode limitation, were entitled to a priority date earlier than the filing date of May 24, 2019. *See* Pet. 9 ("the examiner was misled by the applicant as to the proper priority date during prosecution of [the '323 parent application]."); Prelim. Resp. 13. Petitioner, however, argues that this conclusion was erroneous. Pet. 16–22. According to Petitioner, "[i]n every figure of the '213 patent depicting a lead frame with leads on either side of a transparent plate, only one lead structurally supports the plate." *Id.* at 13. In particular, Petitioner asserts that neither of Figures 22A and B discloses the cathode/anode limitation. *Id.* at 13–15. Petitioner adds, without elaboration, "[t]he other relevant figures of the '213

patent show the same configuration in which only one lead supports the plate. (*E.g.*, Ex. 1003 at FIGS. 4A-B, 8A-B, 10A-22B)." *Id.* at 15.

Patent Owner asserts that the '213 patent's earliest ancestor application, i.e., the '154 application (filed on December 11, 2007), and the '447 provisional (filed on December 11, 2006) each support the cathode/anode limitation according to § 112's first paragraph. *See* Prelim. Resp. 19–21. As an example, Patent Owner contends that Figure 8A in the '213 patent (and the same figure in the '154 application) "clearly illustrates a glass layer 810 structurally supported" by a cathode on a first end and an anode on a second end. *Id.* at 20. To support that contention, Patent Owner provides a highlighted and annotated version of Figure 8A as reproduced below (*id.*):

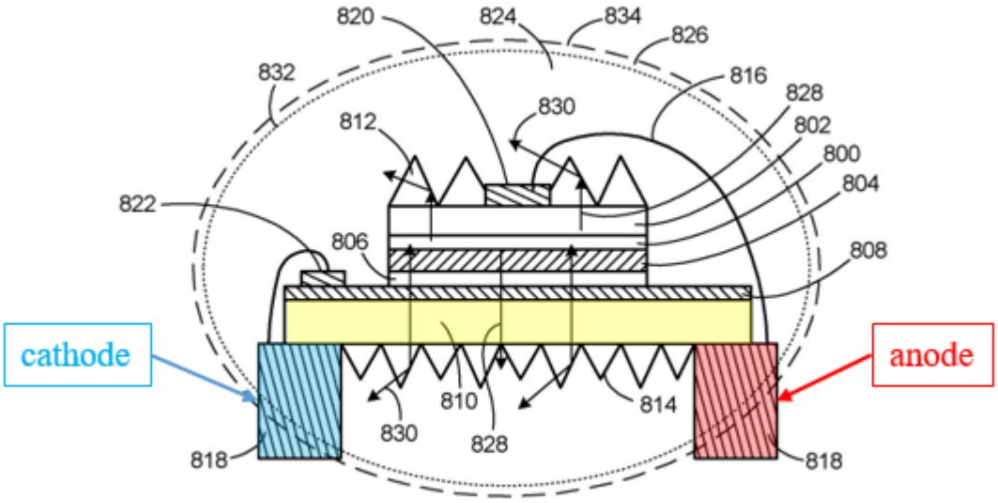


FIG. 8A

Prelim. Resp. 20. The above highlighted and annotated version of Figure 8A illustrates an LED including glass layer 810 and lead frame 818 with glass layer 810 resting on the left and right portions of lead frame 818 and with glass layer 810 highlighted in yellow, the left portion of lead frame 818 highlighted in blue and identified as "cathode," and the right portion of lead frame 818 highlighted in red and identified as "anode." *See* Prelim.

Resp. 20; Ex. 1003, 13:50–55, 13:59–61, Fig. 8A; Ex. 1004 ¶ 99, Fig. 8A. Patent Owner makes similar arguments for Figure 8 of the '447 provisional, which looks very similar to that of Figure 8A, reproduced above. *See* Prelim. Resp. 20–21; Ex. 1026,[14] 19, 37.

3. Analysis

If a patent owner relies on an earlier application to antedate a reference, the patent owner must "show not only the existence of the earlier application, but why the written description in the earlier application supports the claim" according to § 112's first paragraph. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378–79 (Fed. Cir. 2015); *see Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1327 (Fed. Cir. 2008). We agree with Patent Owner that the '154 application and the '447 provisional each support the cathode/anode limitation according to § 112's first paragraph. *See* Prelim. Resp. 19–21.

Figure 8A in the '154 application (and the same figure in the '213 patent) illustrates an LED with lead frame 818 "provid[ing] structural support to" glass layer 810 according to the cathode/anode limitation. Ex. 1004 ¶ 99, Fig. 8A; *see* Ex. 1003, 13:50–55, 13:59–61, Fig. 8A. As Figure 8A shows, the left portion of lead frame 818 supports "a first end of" glass layer 810, and the right portion of lead frame 818 supports "a second end of" glass layer 810. Ex. 1004 ¶ 99, Fig. 8A; *see* Ex. 1003, 13:50–55, 13:59–61, Fig. 8A. An ordinarily skilled artisan would understand that one portion of lead frame 818 corresponds to a cathode and that the other portion

[14] For Exhibit 1026, we cite the page numbers applied to the exhibit, e.g., page 19 of 58, rather than the page numbers appearing in the application.

of lead frame 818 corresponds to an anode. *See* Ex. 1035 ¶¶ 64, 73, 146, 221; Ex. 2005, 169:12–20. Additionally, the '154 application discloses a lead frame supporting a transparent plate and transparent plates "comprised of glass, quartz, sapphire, diamond or other material transparent for the desired emission wavelength." Ex. 1004 ¶¶ 47, 151; *see* Ex. 1003, 8:57–61, 20:34–40. The '447 provisional provides similar disclosure. Ex. 1026, 17–19, 22, 33, 37.

Because Patent Owner has shown sufficiently that the '154 application and the '447 provisional each support the cathode/anode limitation according to § 112's first paragraph, we disagree with Petitioner's assertion that "the '213 patent is not entitled to an effective filing date prior to its actual filing date of September 11, 2019." *See* Pet. 7. Accordingly, for purposes of this Decision, Nakamura-959, Nakamura-949, and Tanda, do not qualify as prior art, and we apply the pre-AIA version of the statutory bases for unpatentability.

III. DISCRETION UNDER 35 U.S.C. § 325(d)

Patent Owner argues we should deny institution because "nearly all of the arguments and alleged art in the Petition were previously considered by the Office." Prelim. Resp. 5. For the reasons discussed below, we are not persuaded by Patent Owner to exercise our discretion to deny institution of *inter partes* review under 35 U.S.C. § 325(d).

A. Legal Framework of 35 U.S.C. § 325(d)

The Director has discretion to institute an *inter partes* review, and has delegated that discretion to the Board. *See* 35 U.S.C. § 314(a); *see also* 37 C.F.R. § 42.4(a). Under § 325(d), in determining whether to institute an *inter partes* review, we "may take into account whether, and reject the

petition . . . because, the same or substantially the same prior art or arguments previously were presented to the Office." 35 U.S.C. § 325(d).

For guidance in exercising this discretion, the Director designated as precedential a portion of the Board's decision in *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17−18 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first para.) ("*Becton*"), which provides six non-exclusive factors for us to consider when deciding whether to exercise discretion to deny review under 35 U.S.C. § 325(d).

> The six non-exclusive *Becton Dickinson* factors are:
>
> (a) the similarities and material differences between the asserted art and the prior art involved during examination;
>
> (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
>
> (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;
>
> (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;
>
> (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and
>
> (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

Becton, Paper 8 at 17–18.

Subsequently, the Director designated as precedential *Advanced Bionics, LLC v. Med-El Electromedizinishe Geräte GMBH*, IPR2019-01469, Paper 6 at 10 (Feb. 13, 2020) ("*Advanced Bionics*") (precedential), which groups the *Becton Dickinson* factors for consideration. Namely, *Advanced Bionics* groups factors (a), (b), and (d) as relating to whether the art and

arguments presented in the petition are the same (or substantially the same) as those previously presented to the Office; and groups factors (c), (e), and (f) as relating to whether the petitioner has demonstrated error by the Office. *Id.* In accordance with these groupings, *Advanced Bionics* provides us with the following two-part framework to apply for our § 325(d) analysis:

> (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and
>
> (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

B. Whether the Same or Substantially the Same Art Was Presented to the Office

We first consider whether Petitioner asserts the same or substantially the same art that was presented previously to the Office. *Advanced Bionics*, Paper 6 at 10. Here, across eleven grounds,[15] Petitioner asserts nine references in arguing that the challenged claims are unpatentable: Nakamura-959, Nakamura-949, Tanda, Yamazaki, Schubert, Uemura, Han, Feldman, and Tadatomo. Pet. 6. Patent Owner argues that all of these references are the same or substantially the same as art that was presented previously to the Office. Prelim. Resp. 6–11. Specifically, Patent Owner asserts, and Petitioner acknowledges, that seven of the nine references—

[15] Petitioner lists these as five grounds (*see* Pet. 6), but Petitioner's "Ground 4" is actually three separate grounds: (1) Yamazaki, Schubert, and Uemura; (2) Yamazaki, Schubert, and Han; and (3) Yamazaki, Schubert, and Feldman, and Petitioner's "Ground 5" is actually five separate grounds: (1) Tanda and Tadatomo; (2) Yamazaki, Schubert, and Tadatomo; (3) Yamazaki, Schubert, Uemura, and Tadatomo; (4) Yamazaki, Schubert, Han, and Tadatomo; and (5) Yamazaki, Schubert, Feldman, and Tadatomo.

Nakamura '959, Nakamura '949, Tanda, Yamazaki, Schubert, Uemura, and Han—were all cited by Patent Owner during prosecution of the '213 patent. *Id.*; Pet. 9. Petitioner also agrees that a 2001 version of Tadatomo was cited during prosecution, and Petitioner does not explain any significant difference between the 2001 version and the version of Tadatomo at issue in this proceeding. *See* Pet. 9. We, therefore, agree that Nakamura '959, Nakamura '949, Tanda, Yamazaki, Schubert, Uemura, Han, and Tadatomo are the same or substantially the same art that was presented previously to the Office. *See Advanced Bionics, Paper 6 at 7–8* ("[p]reviously presented art includes . . . art provided to the Office by an applicant, such as on an [IDS].").

For Feldman, Patent Owner argues that it "is cumulative of the art that was cited during prosecution." Prelim. Resp. 9. Specifically, Patent Owner explains that Petitioner proposes to substitute the lead frames of Feldman, Uemura, and Han into the device disclosed by Yamazaki in the same manner and as if they are interchangeable. *Id.* at 9–10 (citing Pet. 86–88).

We agree with Patent Owner that in the context of its proposed grounds, Petitioner relies on Feldman in the same manner as it relies on Uemura and Han. In fact, Petitioner includes the alternatives of Uemura, Han, and Feldman in the same ground—Ground 4—and describes Feldman as "another use of lead frames in an LED package." Pet. 6, 31; *see also* Pet. 81–82 ("Uemura, Han, and Feldman each disclose simple lead variations for LED packaging."). Accordingly, we find that, for purposes of this proceeding, Feldman's lead frame teaching is cumulative to that of Uemura and Han, and we are persuaded that the relied-upon portion of Feldman is substantially the same as art previously presented to the Office.

C. Whether the Office Erred in a Manner Material to Patentability

"Petitioner must demonstrate that the Examiner erred in the evaluation of the prior art, for example, by showing that the Examiner misapprehended or overlooked specific teachings in the relevant prior art such that the error by the Office was material to the patentability of the challenged claims." *Advanced Bionics, Paper 6* at 21.

As discussed above, for Nakamura-959, Nakamura-949, and Tanda, Petitioner argues that, in prosecution of the '323 parent application, the Examiner mistakenly found written-description support in the '454 provisional for the cathode/anode limitation. Pet. 1, 11–22. Because of this mistake, Petitioner asserts that Nakamura-959, Nakamura-949, and Tanda, should be considered prior art. Pet. 38, 62–63. As explained above, based on the current record, Petitioner has not shown sufficiently that Nakamura-959, Nakamura-949, and Tanda qualify as prior art. Hence, for the challenges based on Nakamura-959, Nakamura-949, and Tanda, Petitioner has not shown that the Examiner erred in a manner material to patentability by allowing the claims over these references.

Petitioner does not identify any specific teaching in Yamazaki, Schubert, Uemura, Han, and Tadatomo that the Examiner misapprehended or overlooked. *See* Pet 9–10. Rather, Petitioner argues that these references "were among the hundreds of references cited by the Patentee during prosecution of the '213 patent." *Id.* at 9. Moreover, of these references "only the Uemura and Han references were specifically discussed by the Office in a related family member (U.S. Patent No. 10,217,916), but the Office cited these references for other reasons and in another manner than presented herein." *Id.*

For the challenges based on Yamazaki and Schubert, however, Petitioner has shown that the Examiner erred in a manner material to patentability by allowing the claims over these references. *See* Pet. 70–92. Although the Examiner initialed most of these references as considered (along with more than 700 other references), the Examiner did not rely on any of these references to reject claims 1 and 2. *See* Ex. 1022, 115–19, 237–39, 244–57, 260–61, 271–90, 311–12. Thus, the record does not establish that the Examiner evaluated these references in the same way as a reference used to reject a claim. And we are not persuaded that the Examiner evaluated these references sufficiently such that a trial would duplicate what occurred during prosecution.

As explained below, based on the current record Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Yamazaki and Schubert teach claim 1's subject matter. *See* Pet. 70–82; Ex. 1035 ¶¶ 237–264; *infra* § IV.F.3. Because of the close relevance and applicability of the teachings of Yamazaki and Schubert to the subject matter of the challenged claims, we find it was error to not apply those references against the claims during prosecution. Thus, we are persuaded that the Examiner erred in a manner material to patentability by overlooking what the combined disclosures in Yamazaki and Schubert would have taught to an ordinarily skilled artisan. *See* Pet. 70–82; Ex. 1022, 115–19, 237–39, 310; Ex. 1035 ¶¶ 237–264.

After weighing the *Becton* factors in view of the *Advanced Bionics* framework, we determine that, on balance, the factors do not favor denying an *inter partes* review. Hence, we decline to exercise our discretion under § 325(d) to deny institution.

IV. ANALYSIS

A. Level of Skill in the Art

The level of skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *See Al-Site Corp. v. VSI Int'l, Inc.*, 174 F.3d 1308, 1323 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)). The level of skill in the art also informs the claim-construction analysis. *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 332 (2015) (explaining that claim construction seeks the meaning "a skilled artisan would ascribe" to the claim term "in the context of the specific patent claim" (emphasis omitted)).

Petitioner asserts that a person of ordinary skill in the art "would have been knowledgeable regarding conventional designs and fabrication techniques pertaining to LEDs, including LED package designs, and would have had at least 2 years of experience in LED design and fabrication as well as at least a master's degree in a relevant field (e.g., chemical engineering, materials engineering, or electrical engineering), or alternatively would have an equivalent combination of advanced education and practical experience." Pet. 10–11 (citing Ex. 1035 ¶¶ 27–29). Patent Owner does not address the level of ordinary skill in the art. *See, generally*, Prelim. Resp.

For purposes of this Decision, we adopt Petitioner's proposal as reasonable and consistent with the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art may reflect an appropriate level of skill in the art).

B. Claim Construction

For petitions filed on or after November 13, 2018, such as the one in this case, we interpret claims in the same manner used in a civil action under

35 U.S.C. § 282(b), "including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b) (2019). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

Both parties agree that no claim terms need be explicitly construed. Pet. 35 ("[E]xplicit constructions do not appear to be necessary in view of the prior art."); Prelim. Resp. 10 ("For purposes of this Preliminary Response, Patent Owner agrees that the claims can be afforded their plain and ordinary meaning and that no construction is necessary for the Board to deny institution.").

We determine that for the purposes of this Decision, it is unnecessary to expressly construe any claim terms. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (only terms in controversy must be construed and only to the extent necessary to resolve the controversy); *see also Nidec*, 868 F.3d at 1017 (citing *Vivid Techs.* in the context of an *inter partes* review).

C. Legal Framework for Unpatentability

In order to find a claim anticipated, we must find not only that all elements of a claim are disclosed within the four corners of a single prior-art reference, but that the elements are "arranged as in the claim." *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008).

A 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

claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains." We resolve the question of obviousness 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 skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.[16] *See Graham*, 383 U.S. at 17–18.

D. Grounds Based on Nakamura-959 and Nakamura-949

Petitioner contends that claims 1 and 2 are unpatentable because the claimed subject matter would have been obvious over the combined disclosures of Nakamura-959 and Nakamura-949. Pet. 6, 62–71, 87–89. As discussed above, because Patent Owner has shown sufficiently that the '154 application and the '447 provisional each support the cathode/anode limitation according to § 112's first paragraph, we disagree with Petitioner's assertion that "the '213 patent is not entitled to an effective filing date prior to its actual filing date of September 11, 2019." *See* Pet. 7. Thus, based on the current record, Petitioner has not shown sufficiently that Nakamura-959 and Nakamura-949 qualify as prior art. Hence, Petitioner has not demonstrated a reasonable likelihood of prevailing in proving claims 1 and 2 unpatentable under § 103 as obvious over Nakamura-959 and Nakamura-949.

[16] The record does not include allegations or evidence of objective indicia of nonobviousness.

E. Grounds Based on Tanda

Petitioner contends that claim 1 is unpatentable because it is anticipated by Tanda, and claim 2 is unpatentable because its subject matter would have been obvious over the combined disclosures of Tanda and Tadatomo. Pet. 6, 38–62. For the reasons discussed above, Patent Owner has shown sufficiently that the '447 provisional supports the cathode/anode limitation according to § 112's first paragraph. *See* Ex. 1026, 17–19, 22, 33, 37; *supra* § IV.E.4. Petitioner does not contend that the '447 provisional lacks support for claim 1's other limitations. *See, e.g.*, Pet. 12–21. And based on the current record, Patent Owner has shown sufficiently that the '447 provisional supports claim 1's other limitations. *See, e.g.*, Ex. 1026, 17–19, 22, 33, 37; Prelim. Resp. 30–31.

Because the '447 provisional's December 11, 2006, filing date precedes Tanda's December 14, 2006, filing date and because Patent Owner has shown sufficiently that the '447 provisional supports claim 1 according to § 112's first paragraph, Petitioner has not shown sufficiently that Tanda qualifies as prior art. Hence, Petitioner has not demonstrated a reasonable likelihood of prevailing in proving that claim 1 is unpatentable under § 102 as anticipated by Tanda or that claim 2 is unpatentable under § 103 as obvious over Tanda combined with Tadatomo.

F. Grounds Based on Yamazaki and Schubert (claim 1)

Petitioner contends that claim 1 is unpatentable because its subject matter would have been obvious over the combined disclosures of Yamazaki and Schubert. Pet. 6, 71–80.

1. Yamazaki

Yamazaki is a Japanese patent publication titled "Semiconductor Light-Emitting Device," which describes an LED "that emits light in a plurality of directions through a simple structure." Ex. 1007, codes (54), (57). Figure 1 of Yamazaki is reproduced below.

[FIG. 1]

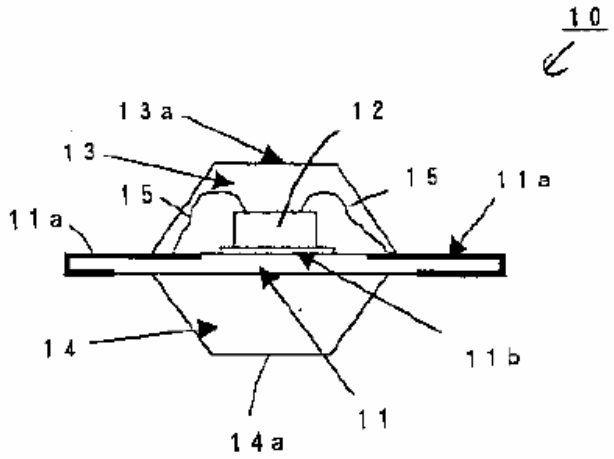


Figure 1 of Yamazaki depicts LED 10 with light-emitting chip 12 that is mounted on chip substrate 11, "a first resin molding portion 13 that is formed so as to cover the light-emitting chip 12 and also the entirety of the surface of the chip substrate 11," and "a second resin molding portion 14 that is formed so as to cover the entirety of the back face of the chip substrate 11." Ex. 1007 ¶ 25.

2. Schubert

Schubert is a book published in 2003 titled "Light-Emitting Diodes." Ex. 1008. It states that "[t]o date GaInN is the primary material system for

high-brightnesss blue and green LEDs." Ex. 1008, 176.[17] Schubert also states that sapphire and SiC substrates are "commonly used." *Id.*

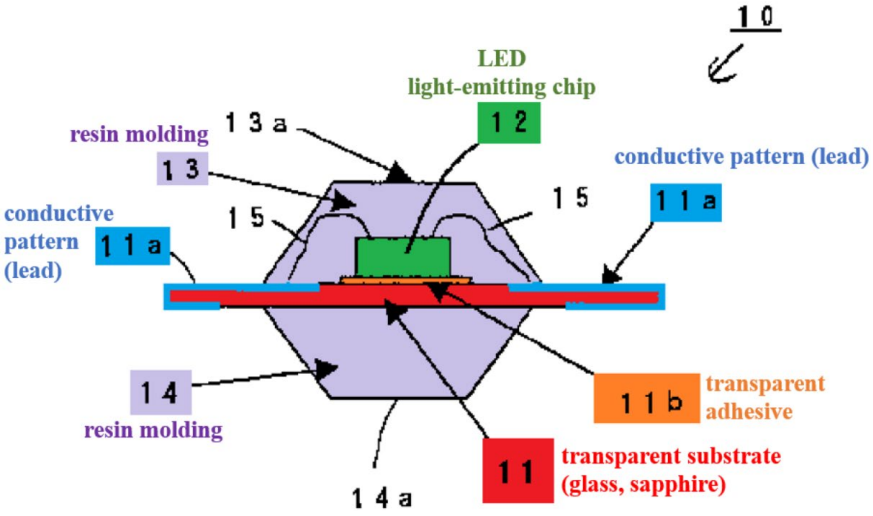
3. Claim 1

Petitioner relies on Yamazaki for all the limitations of claim 1 except that "Yamazaki does not specify its LEDs' material system." Pet. 71. Petitioner turns to Schubert to show that "the III-nitride material system (and more particularly the InGaN system) was the primary material system for commercially-available blue LEDs and that such LEDs commonly used sapphire growth substrates." *Id.*

For the cathode/anode limitation, Petitioner asserts that Yamazaki's Figure 1 shows "anode and cathode leads" at the edges of chip substrate 11 "with each lead structurally supporting the surface by wrapping around the surface." *Id.* at 74. To support Petitioner's assertion, Dr. Dupuis testifies that "Yamazaki depicts metallic portions that are thick in relation to the plate, cover portions of the top and bottom of the plate, and wrap around opposite edges, all of which show that the leads provide structural support to the plate." Ex. 1035 ¶ 246; *see id.* ¶ 109.

Additionally, Dr. Dupuis provides a highlighted and annotated version of Yamazaki's Figure 1 as reproduced below (Ex. 1035 ¶ 246):

[17] Exhibit 1008 has two sets of page numbers. For purposes of this Decision, we refer to the page numbers, added by Petitioner, in the bottom right corner of the document.



The above highlighted and annotated version of Figure 1 shows "semiconductor light-emitting device 10" with chip substrate 11 highlighted in red and identified as "transparent substrate (glass, sapphire)," electrically conductive pattern 11a highlighted in blue and identified as "conductive pattern (lead)," adhesive agent 11b highlighted in orange and identified as "transparent adhesive," light-emitting chip 12 highlighted in green and identified as "LED light-emitting chip," and molding portions 13 and 14 highlighted in purple and identified as "resin molding." *See* Ex. 1035 ¶ 246.

Citing Dr. Dupuis's testimony, Petitioner asserts that "there were two conventional ways to produce these conductive patterns: stamping sheet metal to form j-shaped leads to wrap around the plate, or depositing/etching a metal film." Pet. 75 (citing Ex. 1035 ¶ 246). Petitioner then contends that Yamazaki's Figure 1 "at least teaches and suggests the j-lead structure" given (1) "the relative thickness of the metal" in Figure 1, (2) the j-lead structure "was simpler to implement than depositing a film around the edges of a plate," and (3) "films were more typically deposited using through-holes to connect top and bottom surfaces, rather than around the edges of a plate." *Id.* (citing Ex. 1017 ¶ 22, Figs. 3–4; Ex. 1035 ¶ 246). Petitioner also

contends that an ordinarily skilled artisan would have known or understood "Yamazaki's conductive leads 11a to at least teach and suggest relatively thick 'j-lead' metal leads that provide structural support." *Id.* at 75–76 (citing Ex. 1035 ¶ 246).

Patent Owner disputes that Yamazaki teaches the cathode/anode limitation. *See* Prelim. Resp. 27–31. Specifically, Patent Owner asserts that Yamazaki "does not expressly state that the electrically conductive patterns 11a are on the top and bottom surfaces of the chip substrate 11, or that they structurally support the chip substrate." *Id.* at 28. Patent Owner also asserts that Yamazaki's Figures 2 and 3 undermine Petitioner's position that conductive patterns 11a wrap around opposite edges of chip substrate 11. *Id.* at 28–29. For Figure 2's top view of chip substrate 11, Patent Owner contends that it "illustrates a gap" between the substrate's edges and the conductive patterns, and thus suggests that the conductive patterns do not wrap around the substrate's edges. *Id.* at 28. For Figure 3's bottom view of chip substrate 11, Patent Owner contends that it "does not contain a reference numeral for the electrically conductive patterns 11a," and thus suggests that "they are not present on" the substrate's bottom surface. *Id.* at 29.

Patent Owner further asserts that even if "Petitioner were correct that it is likely that the electrically conductive patterns 11a are stamped metal 'j-shaped leads,' this is insufficient to establish that Yamazaki inherently discloses a cathode and anode providing structural support as required in claim 1." Prelim. Resp. 30.

Based on the current record, Petitioner establishes sufficiently for purposes of institution that Yamazaki teaches the cathode/anode limitation.

See Pet. 74–76; Ex. 1035 ¶¶ 246–247. Yamazaki's Figure 1 shows electrically conductive patterns 11a at opposite edges of chip substrate 11 with each conductive pattern wrapping around an edge of the substrate. Ex. 1007 Fig. 1; *see* Ex. 1035 ¶ 246. As Dr. Dupuis testifies, "Yamazaki depicts metallic portions that are thick in relation to the plate, cover portions of the top and bottom of the plate, and wrap around opposite edges, all of which show that the leads provide structural support to the plate." Ex. 1035 ¶ 246. An ordinarily skilled artisan would have understood that the conductive pattern at one edge corresponds to a cathode and that the conductive pattern at the other edge corresponds to an anode. *See id.* ¶¶ 64, 146, 221, 246; Ex. 2007, 169:12–20.

The top and bottom views of chip substrate 11 in Figures 2 and 3 appear to support Petitioner's position that conductive patterns 11a wrap around opposite edges of chip substrate 11 because the figures appear to show the conductive pattern on the substrate's top surface (Figure 2) and on the substrate's bottom surface (Figure 3). Ex. 1007, Figs. 2–3; *see* Ex. 1035 ¶ 246. Further, Figure 1's cross-sectional view shows conductive patterns 11a but not reflecting film 16, and thus indicates that conductive patterns 11a have a greater thickness than reflecting film 16. Ex. 1007, Fig. 1. For this reason too, Yamazaki's figures support Petitioner's position that an ordinarily skilled artisan would have known or understood that conductive patterns 11a most likely correspond to j-shaped leads instead of metal films.

Additionally, Dr. Dupuis's testimony supports Petitioner's position. *See* Ex. 1035 ¶ 246. At this stage of the proceeding, Patent Owner does not

present testimony contradicting Dr. Dupuis's testimony or supporting its contentions concerning Figures 2 and 3.

As for Patent Owner's assertion that even if "Petitioner were correct that it is likely that the electrically conductive patterns 11a are stamped metal 'j-shaped leads,' this is insufficient to establish that Yamazaki inherently discloses a cathode and anode providing structural support as required in claim 1," Petitioner does not rely on an inherency theory. *See* Pet. 74–76. Instead, Petitioner relies on Yamazaki's express disclosure of electrically conductive patterns 11a at opposite edges of chip substrate 11 with each conductive pattern wrapping around an edge of the substrate. *See* Pet. 74–76; Ex. 1035 ¶ 246.

A patent or published application need not "explain every detail" since it speaks to "those skilled in the art." *See In re Howarth*, 654 F.2d 103, 105 (CCPA 1981). Yamazaki lacks detail about the structure of conductive patterns 11a. *See, e.g.*, Ex. 1007 ¶¶ 26, 31–32. But Petitioner identifies evidence showing that an ordinarily skilled artisan would have known or understood that conductive patterns 11a most likely correspond to j-shaped leads instead of metal films. *See* Pet. 76–77; Ex. 1035 ¶ 246. To establish obviousness, a patent challenger may rely on an ordinarily skilled artisan's knowledge or understanding. *See, e.g.*, *SIPCO, LLC v. Emerson Elec. Co.*, 980 F.3d 865, 871 (Fed. Cir. 2020); *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337–38 (Fed. Cir. 2020).

As for the combination of Schubert with Yamazaki, Petitioner asserts that Schubert shows "that the III-nitride material system (and more particularly the InGaN system) was the primary material system for commercially-available blue LEDs and that such LEDs commonly used

sapphire growth substrates." Pet. 71. Moreover, Petitioner asserts that an ordinarily skilled artisan "would reasonably expect the blue LEDs of Yamazaki to be III-nitride LEDs having sapphire growth substrates and would have found it obvious to use III-nitride LEDs having sapphire growth substrates with the Yamazaki device." *Id.* at 71–72. Dr. Dupuis's testimony supports Petitioner's assertion. *See* Ex. 1035 ¶¶ 238, 248–251.

Patent Owner asserts that "Petitioner fails to articulate any alleged motivation to combine Yamazaki and Schubert." Prelim. Resp. 27 (emphasis omitted); *see id.* at 33–34. Patent Owner also asserts that Petitioner improperly "purports to rely on disclosures from" several additional references, including "Uemura, Tadatomo, Shimizu, and alleged admitted prior art." *Id.* at 34 (citing 37 C.F.R. § 42.104(b)(2)).

Based on the current record, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have had reason to combine Yamazaki and Schubert. Petitioner cites Schubert to show an ordinarily skilled artisan's knowledge about conventional blue LEDs as disclosed in Yamazaki, i.e., that "conventional blue LEDs were III-nitride-based LEDs that commonly included sapphire growth substrates." *See* Pet. 71–72, 76–77; Ex. 1007 ¶ 27 (stating the disclosed light-emitting chip "is of a publicly known structure"). Petitioner does not cite Schubert to show that the prior art includes a limitation that Yamazaki lacks. *See* Pet. 70–71, 76–77. Under these circumstances, Petitioner need not "demonstrate a sufficient motivation to combine the two references." *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1372–73 (Fed. Cir. 2019).

Regarding Patent Owner's assertion that Petitioner improperly "purports to rely on disclosures from" several additional references,

Petitioner cites the additional references to support its showing about an ordinarily skilled artisan's knowledge of conventional blue LEDs, i.e., that "conventional blue LEDs were III-nitride-based LEDs that commonly included sapphire growth substrates." *See* Pet. 26, 70–72, 76–77. To establish obviousness, a patent challenger may rely on an ordinarily skilled artisan's knowledge or understanding. *See, e.g.*, *SIPCO*, 980 F.3d at 871; *Koninklijke Philips*, 948 F.3d at 1337–38.

Petitioner's analysis addresses every limitation in claim 1. *See supra* § IV.F.3. Thus, based on the current record, Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Yamazaki and Schubert teach claim 1's subject matter. Hence, Petitioner demonstrates a reasonable likelihood of prevailing in proving claim 1 unpatentable under § 103(a) as obvious over Yamazaki and Schubert.

G. Grounds Based Yamazaki, Schubert, and Uemura/Han/Feldman (claim 1)

Petitioner contends that claim 1 is unpatentable because its subject matter would have been obvious over the combined disclosures of (1) Yamazaki, Schubert, and Uemura; (2) Yamazaki, Schubert, and Han; and (3) Yamazaki, Schubert and Feldman. Pet. 6, 80–87. For the reasons explained below, Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Yamazaki, Schubert, and either Uemura, Han, or Feldman teach claim 1's subject matter.

1. Uemura

Uemura is a U.S. patent titled "Light-Emitting Apparatus," filed on August 3, 1999, and issued on October 30, 2001. Ex. 1009, codes (22), (45), (54). Uemura states that the invention "relates to a light-emitting

apparatus," in particular, "a light-emitting apparatus having a semiconductor light-emitting device integrated by flip chip bonding." *Id.* at 1:5–9.

Uemura's Figure 1 (reproduced below) depicts a light-emitting apparatus:

FIG. 1

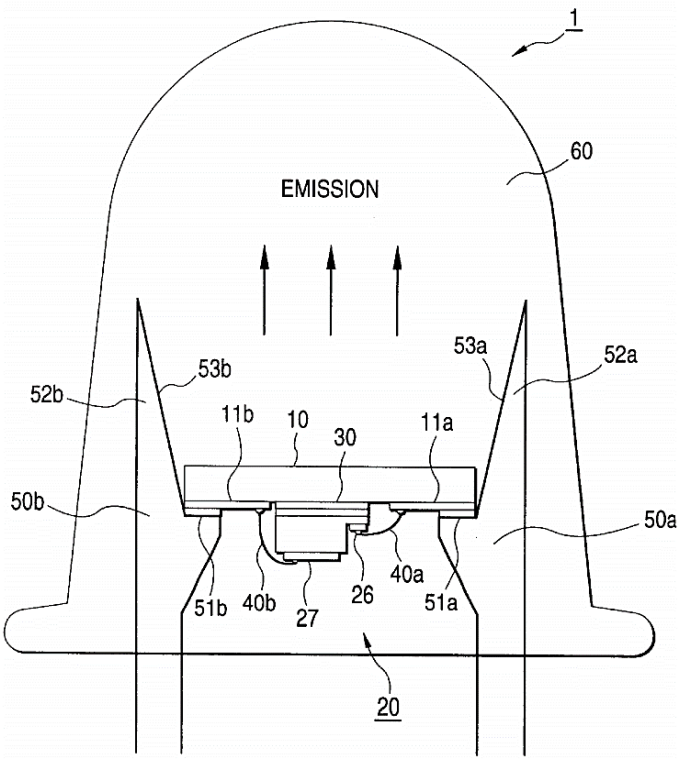


Figure 1 illustrates light-emitting apparatus 1 including "a transparent base 10, a light-emitting device 20, an adhesive layer 30, wires 40a and 40b, lead frames 50a and 50b, and a sealing resin 60." Ex. 1009, 3:66–67, 4:18–23, Fig. 1.

Light-emitting device 20 includes "a substrate 21, GaN-based semiconductor layer, a negative electrode 26, and a positive electrode 27." Ex. 1009, 4:62–64, Fig. 1. "The substrate 21 can be made of any transparent material, such as sapphire." *Id.* at 4:64–65. "[T]he base 10 is fitted to the

lead frames 50a and 50b in such a manner that the side of the substrate 21 of the light-emitting device 20 faces the dominant light-emitting direction." *Id.* at 5:54–57.

Lead frames 50a and 50b have "mounts 51a and 51b to which the bonding pads 11a and 11b are fixed." Ex. 1009, 7:55–56, Fig. 1. Lead frames 50a and 50b "preferably have projections 52a and 52b" extending from the respective mounts 51a and 51b in the dominant light-emitting direction. *Id.* at 5:66–6:5, 7:56–58, Fig. 1. "The inner walls 53a and 53b of the projections 52a and 52b prevent" light from diffusing laterally by reflecting light toward the dominant light-emitting direction. *Id.* at 7:58–60; *see id.* at 5:66–6:5.

2. Han

Han is a Korean registered patent titled "Light Emitting Diode with Reflective Structure," filed on October 28, 2005, and published on September 20, 2006. Ex. 1010, codes (22), (45), (54). Han states that the invention "relates to a light emitting diode with a reflective structure, the light emitting diode having improved light extraction efficiency." *Id.* at 1.

Han's Figure 1 (reproduced below) depicts a light-emitting diode with a reflective structure:

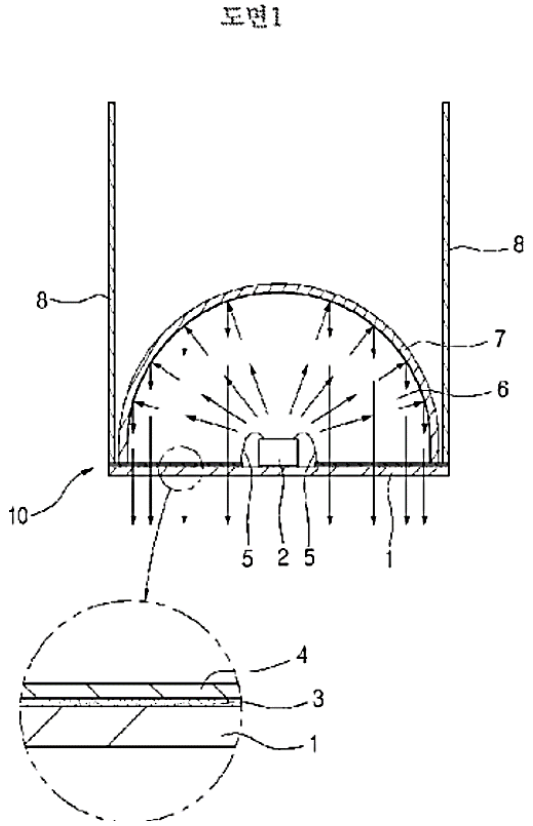


Figure 1 illustrates light-emitting diode 10 including glass substrate 1, LED chip 2, transparent joining member 3, electrode 4, wire 5, mold 6, reflective body 7, and lead frame 8. Ex. 1010, 4, Fig. 1; *see id.* at 2. Reflective body 7 reflects light emitted from LED chip 2, and the reflected light passes through mold 6 to exit light-emitting diode 10 in "a forward direction." *Id.* at 4.

Lead frame 8 supplies power to LED chip 2 through electrode 4 and wire 5. Ex. 1010, 4. Specifically, lead frame 8 connects to electrode 4, and wire 5 connects electrode 4 to an electrode (not shown) on LED chip 2. *Id.*

3. Feldman

Feldman is a U.S. patent titled "Methods and Apparatus for a Light Source with a Raised LED Structure," filed on December 28, 1999, and

issued on December 23, 2003. Ex. 1011, codes (22), (45), (54). Feldman states that the invention "generally relates to lighting systems, and more particularly, to light sources implementing light emitting diodes (LEDs)" with LEDs raised above the floor of an optical cavity. *Id.* at 1:8–10, 2:34–36.

Feldman's Figure 4 (reproduced below) depicts an LED raised above the floor of an optical cavity:

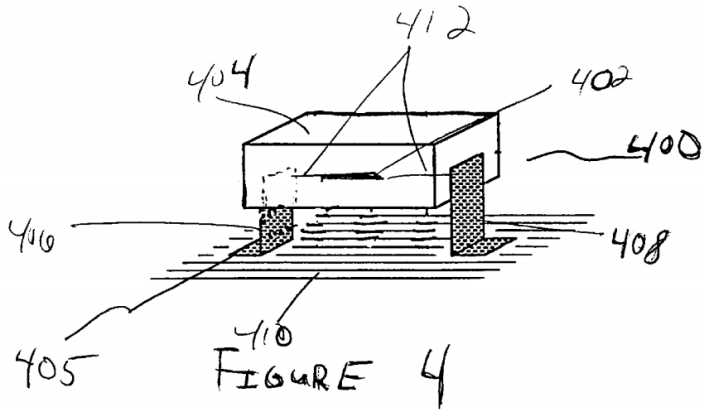


Figure 4 illustrates LED 400 including "a diode 402 encased in a translucent rectangular package 404." Ex. 1011, 4:8–10, Fig. 4; *see id.* at 2:62–64. LED 400 "is raised by a support system 405 such that the base of LED 400 is elevated above the floor 410 of optical cavity 502." *Id.* at 4:10–12.

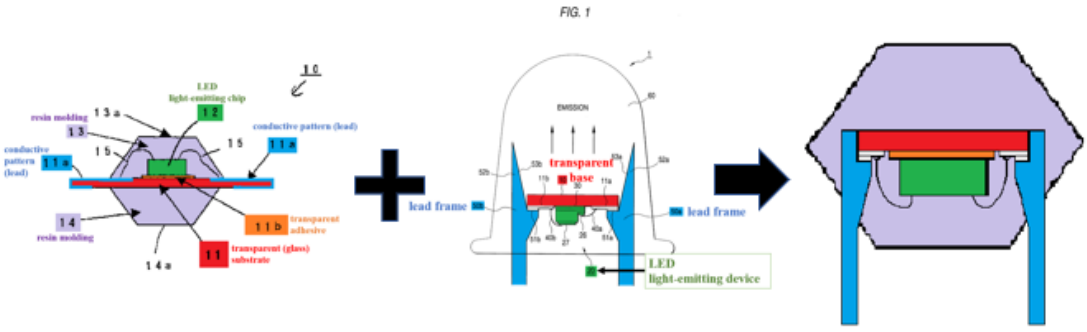
Support system 405 "comprises a pair of L-brackets 406 and 408 attached to either side of the LED 400 to support the LED 400" above floor 410. Ex. 1011, 4:12–15, Fig. 4. L-brackets 406 and 408 "may be constructed of a suitable electrically conductive material" to support LED 400 above floor 410 and may connect through a circuit board to a power source. *Id.* at 4:21–30. Lead frame 412 "electrically connects the diode 402 with L-brackets 406 and 408." *Id.* at 4:26–27, Fig. 4.

4. Analysis

Petitioner relies on Yamazaki and Schubert for disclosing the limitations in claim 1 except the cathode/anode limitation. *See* Pet. 80–81. For the cathode/anode limitation, Petitioner asserts that Yamazaki in view of any one of Uemura, Han, and Feldman discloses this limitation. *Id.* at 81. In particular, Petitioner contends that Uemura, Han, and Feldman disclose "simple, well-known designs for configuring a lead frame structure, each of which discloses a known and predictable way of connecting leads to an LED chip package." Pet. 80–81; Ex. 1035 ¶¶ 267–268. Petitioner also contends that an ordinarily skilled artisan would have made "simple substitutions" based on those "alternative lead frame designs" to "facilitate alternative packaging/mounting arrangements." Pet. 81–82, 85.

a. The Cathode/Anode Limitation

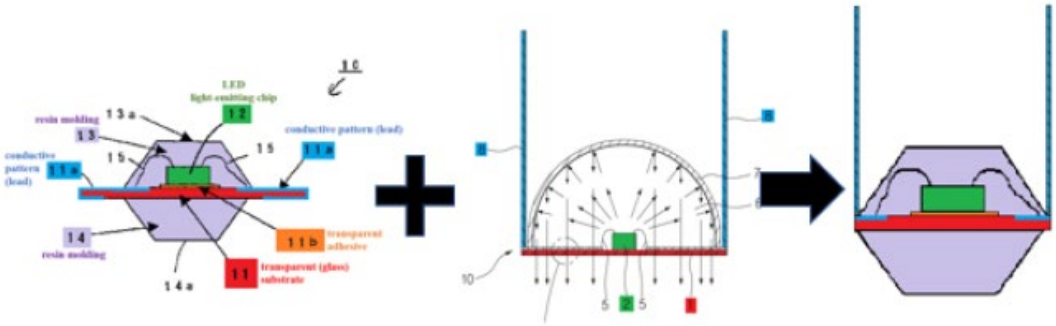
For Uemura's lead-frame design, Petitioner asserts that an ordinarily skilled artisan would have employed Uemura's vertically oriented leads connected "inside the package's molding" for vertical mounting above another structure. Pet. 85; *see id.* at 88. To depict the resulting arrangement, Petitioner provides the diagram reproduced below (*id.* at 85):



This diagram depicts an arrangement resulting from a combination of structures shown in Yamazaki's Figure 1 and Uemura's Figure 1 with

Uemura's vertically oriented leads connected "inside the package's molding" for vertical mounting above another structure. *See* Pet. 82; Ex. 1035 ¶¶ 269–272. Petitioner contends that this arrangement includes "an anode and a cathode on opposite ends of a transparent surface, with each of the anode and cathode configured to structurally support the transparent surface and provide electrical connectivity to external structures" according to the cathode/anode limitation. Pet. 85–86; *see* Ex. 1035 ¶ 281.

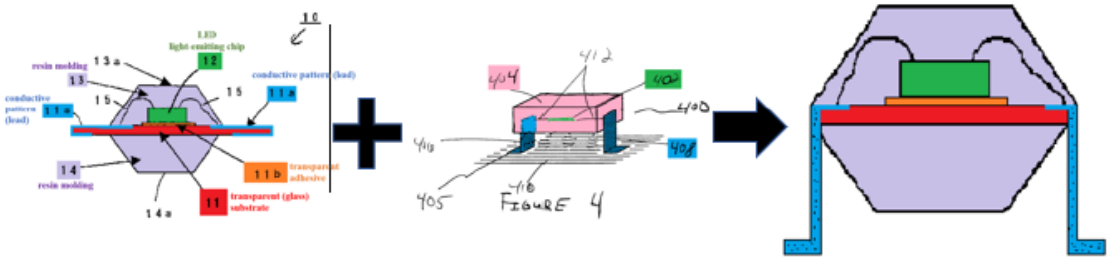
For Han's lead-frame design, Petitioner asserts that an ordinarily skilled artisan would have employed Han's vertically oriented leads connected "outside of the package's molding" for vertical mounting below another structure. Pet. 83. To depict the resulting arrangement, Petitioner provides the diagram reproduced below (*id.* at 83):



This diagram depicts an arrangement resulting from a combination of structures shown in Yamazaki's Figure 1 and Han's Figure 1 with Han's vertically oriented leads connected "outside of the package's molding" for vertical mounting below another structure. *See* Pet. 83; Ex. 1035 ¶ 275. Petitioner contends that this arrangement includes "an anode and a cathode on opposite ends of a transparent surface, with each of the anode and cathode configured to structurally support the transparent surface and

provide electrical connectivity to external structures" according to the cathode/anode limitation. Pet. 85–86; *see* Ex. 1035 ¶ 281.

For Feldman's lead-frame design, Petitioner asserts that an ordinarily skilled artisan would have employed Feldman's vertically oriented L-brackets connected to "the conductive pattern on Yamazaki's plate" to elevate the LEDs above another structure, e.g., a circuit board. Pet. 84–85. To depict the resulting arrangement, Petitioner provides the diagram reproduced below (*id.* at 84):



This diagram depicts an arrangement resulting from a combination of structures shown in Yamazaki's Figure 1 and Feldman's Figure 4 with Feldman's vertically oriented L-brackets connected to "the conductive pattern on Yamazaki's plate" to elevate the LEDs above another structure. *See* Pet. 84; Ex. 1035 ¶ 277. Petitioner contends that this arrangement includes "an anode and a cathode on opposite ends of a transparent surface, with each of the anode and cathode configured to structurally support the transparent surface and provide electrical connectivity to external structures" according to the cathode/anode limitation. Pet. 85–86; *see* Ex. 1035 ¶ 281.

Patent Owner does not dispute that (1) Uemura discloses vertically oriented leads, (2) Han discloses vertically oriented leads, and (3) Feldman discloses vertically oriented L-brackets. *See* Prelim. Resp. 34–44.

Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the current record, and for the reasons Petitioner states, Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Yamazaki and either Uemura, Han, or Feldman teach the cathode/anode limitation. *See* Pet. 80–87; Ex. 1035 ¶¶ 268–278, 280–282.

b. Alleged Motivation to Combine

As for why a person of ordinary skill in the art would have combined the teachings of Uemura, Han, or Feldman with those of Yamazaki, Petitioner asserts that Uemura, Han, and Feldman disclose "alternative lead frame designs" that may replace Yamazaki's horizontally oriented leads, i.e., electrically conductive patterns 11a. Pet. 85–86. Petitioner also asserts that an ordinarily skilled artisan would have been motivated to modify Yamazaki's light-emitting device based on those "alternative lead frame designs" to "facilitate alternative packaging/mounting arrangements." *Id.* at 81–82, 85–86. Dr. Dupuis's testimony supports Petitioner's assertions. *See* Ex. 1035 ¶¶ 268–278.

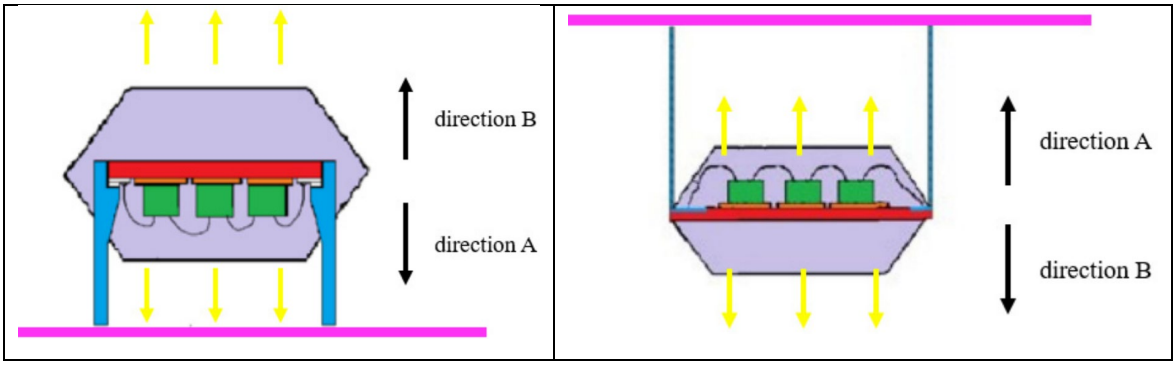
Patent Owner contends that Petitioner "never explains why" an ordinarily skilled artisan would have been motivated to replace Yamazaki's horizontally oriented leads with either Uemura's vertically oriented leads, Han's vertically oriented leads, or Feldman's vertically oriented L-brackets. Prelim. Resp. 37, 41, 43 (emphasis omitted) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Patent Owner overlooks Petitioner's explanation that the "alternative lead frame designs" of Uemura, Han, and Feldman would have "facilitate[d]

alternative packaging/mounting arrangements." *See* Pet. 81–85; Ex. 1035 ¶¶ 269–278. Any "need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining" references. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007). At this stage of the proceeding, "facilitat[ing] alternative packaging/ mounting arrangements" suffices as a reason to combine Yamazaki's teachings with the teachings of Uemura, Han, and Feldman. *See* Pet. 81–85; Ex. 1035 ¶¶ 268–278.

Patent Owner contends that each proposed combination "would render Yamazaki in operable [sic] for its intended purpose." Prelim. Resp. 38–39, 41–42, 44. Specifically, Patent Owner asserts that Yamazaki seeks "to provide a semiconductor light-emitting device that emits light in a plurality of directions through a simple structure." *Id.* at 35 (emphasis omitted) (quoting Ex. 1007 ¶ 8). Patent Owner also asserts that in each proposed combination the mounting surface would block light emitted in one direction. *Id.* at 39–40, 42, 44.

To illustrate the mounting surface blocking light in the proposed combination with Uemura and the proposed combination with Han, Patent Owner provides the diagrams reproduced below (Prelim. Resp. 38, 41):



The diagram above on the left illustrates a light-emitting device according to the proposed combination with Uemura that emits light (shown in yellow)

upwardly (identified as direction B) and downwardly (identified as direction A) where a mounting surface (shown in pink) below the light-emitting device blocks light emitted downwardly but not light emitted upwardly. *See id.* at 38–39. The diagram above on the right illustrates a light-emitting device according to the proposed combination with Han that emits light (shown in yellow) upwardly (identified as direction A) and downwardly (identified as direction B) where a mounting surface (shown in pink) above the light-emitting device blocks light emitted upwardly but not light emitted downwardly. *See id.* at 41–42.

For each proposed combination, Patent Owner's assertion about the mounting surface blocking light emitted in one direction appears to assume an arrangement with a solid mounting surface that blocks light. Prelim. Resp. 38–39, 41–42, 44. Based on the current record, however, we see no reason to assume an arrangement with a solid mounting surface that blocks light rather than a mounting surface with apertures that allow light to pass. An obviousness analysis should "take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418.

Patent Owner argues that Yamazaki "disparages and teaches away from LEDs, like those in Uemura, where 'light is emitted in a single direction.'" Prelim. Resp. 39 (quoting Ex. 1007 ¶ 7). We disagree that Yamazaki "disparages and teaches away from" the proposed combination with Uemura. A reference does not teach away "if it merely expresses a general preference for an alternative invention but does not 'criticize, discredit, or otherwise discourage' investigation into the invention claimed." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327

(Fed. Cir. 2009) (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)).

Yamazaki describes light-emitting devices that emit light in "a single direction" as having a "problem." Ex. 1007 ¶ 7. To address that "problem," Yamazaki explains that the invention endeavors "to provide a semiconductor light-emitting device that emits light in a plurality of directions through a simple structure." *Id.* ¶ 8, code (57). When disclosing a light-emitting device that emits light in a plurality of directions, Yamazaki does not "criticize, discredit, or otherwise discourage" use of Uemura's vertically oriented leads. *See, e.g.*, *id.* ¶¶ 7–8, 25–39, code (57).

Additionally, Dr. Dupuis testifies that (1) Uemura's vertically oriented leads "include optional reflective projections for directing light emissions in a dominant direction" and (2) an ordinarily skilled artisan would not have used those reflective projections in the proposed combination because doing so "would not make sense in the context of Yamazaki's intended multi-directional light emissions." Ex. 1035 ¶ 272; *see* Pet. 85 n.16. At this stage of the proceeding, Patent Owner identifies no evidence contradicting Dr. Dupuis's testimony. *See, e.g.*, Prelim. Resp. 34–44.

Patent Owner contends that Han "concentrate[s] light from the LED in only one direction" and that Yamazaki "teaches away from Han's unidirectional LED." Prelim. Resp. 42 (citing Ex. 1007 ¶ 7). We disagree that Yamazaki "teaches away from" the proposed combination with Han. Yamazaki does not "criticize, discredit, or otherwise discourage" use of Han's vertically oriented leads. *See, e.g.*, Ex. 1007 ¶¶ 7–8, 25–39, code (57).

Based on the current record, and for the reasons Petitioner states, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have been motivated to modify Yamazaki's light-emitting device based on the "alternative lead frame designs" of Uemura, Han, and Feldman, i.e., to "facilitate alternative packaging/ mounting arrangements." *See* Pet. 80–87; Ex. 1035 ¶¶ 268–278.

Because, as discussed above, Petitioner also establishes sufficiently for purposes of institution that the combined disclosures in Yamazaki, Schubert, and either Uemura, Han, or Feldman teach claim 1's subject matter, Petitioner demonstrates a reasonable likelihood of prevailing in proving claim 1 unpatentable under § 103(a) as obvious over Yamazaki, Schubert, and either Uemura, Han, or Feldman.

H. Grounds Based Yamazaki, Schubert, Uemura/Han/Feldman, and Tadatomo (claim 2)

Petitioner contends that claim 2 is unpatentable because its subject matter would have been obvious over the combined disclosures of (1) Yamazaki, Schubert, and Tadatomo; (2) Yamazaki, Schubert, Uemura, and Tadatomo; (3) Yamazaki, Schubert, Han, and Tadatomo; and (4) Yamazaki, Schubert, Feldman, and Tadatomo. Pet. 87–89. For the reasons explained below, Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Tadatomo and the other references in each Yamazaki-based combination teach claim 2's subject matter.

1. Tadatomo

Tadatomo is an article titled "High Output Power Near-Ultraviolet and Violet Light-Emitting Diodes Fabricated on Patterned Sapphire

Substrates Using Metalorganic Vapor Phase Epitaxy." Ex. 1020, 243. It discusses improving the performance and reliability of LEDs by using patterned sapphire substrate. *Id.* at 243–44.

2. Analysis

Petitioner asserts that an ordinarily skilled artisan would have been motivated to use Tadatomo's patterned sapphire substrate with Yamazaki's LEDs because "Tadatomo discloses that growing semiconductor layers on a patterned sapphire substrate ('PSS') rather than a conventional sapphire substrate ('CSS') reduces undesirable dislocation density and increases light extraction efficiency." Pet. 87. Dr. Dupuis's testimony supports Petitioner's assertions. *See* Ex. 1035 ¶¶ 289–291.

Patent Owner makes no arguments against combining Tadatomo's teachings with Yamazaki's teachings. *See* Prelim. Resp. 45. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the current record, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have had a reason to combine Tadatomo's teachings with Yamazaki's teachings. *See* Pet. 87; Ex. 1035 ¶¶ 289–290. Tadatomo reports that "the PSS is very effective in reducing the dislocation density and for increasing the extraction efficiency due to the multiple scattering of the emission light at the GaN/ patterned sapphire interface." Ex. 1012, 7; *see* Ex. 1035 ¶ 290 (quoting Ex. 1012, 7). According to Dr. Dupuis, that disclosure would have motivated an ordinarily skilled artisan "to use the PSS technology to both improve the internal quantum efficiency (by the reduction of the defect density in the GaN materials) and to improve the external quantum

efficiency (by the improvement of the light extraction efficiency from the LED chip)." Ex. 1035 ¶ 290.

Thus, based on the current record, Petitioner establishes sufficiently for purposes of institution that the combined disclosures in Tadatomo and the other references in each Yamazaki-based combination teach claim 2's subject matter. Hence, Petitioner demonstrates a reasonable likelihood of prevailing in proving claim 2 unpatentable under § 103(a).

V. CONCLUSION

We have determined that Petitioner has sufficiently demonstrated the factual basis necessary to support the majority of its unpatentability contentions. Based on the arguments in the Petition and the Preliminary Response, therefore, we determine that Petitioner has established a reasonable likelihood of prevailing in showing that at least one claim of the '213 patent is unpatentable.

Our factual findings, conclusions of law, and determinations at this stage of the proceeding are preliminary and based on the evidentiary record developed thus far. This is not a final decision as to the patentability of claims for which *inter partes* review is instituted. Our final decision will be based on the record as fully developed during trial.

ORDER

Accordingly, it is:

ORDERED that an *inter partes* review of claims 1 and 2 of the '213 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '213 patent is hereby instituted commencing on the

entry date of this Decision, and 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.

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