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571-272-7822

Paper 57
Entered: November 4, 2022

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*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
Denying Petitioner's Motion to Exclude
Denying Patent Owner's Motion to Exclude
35 U.S.C. § 318(a)

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.").

We instituted review on November 8, 2021. Paper 13 ("Inst. Dec."). Subsequent to institution, Patent Owner filed a Request for Rehearing (Paper 17), which we denied (Paper 18). Patent Owner then filed a Patent Owner Response (Paper 28[1], "PO Resp."), Petitioner filed a Reply (Paper 33, "Reply"), and Patent Owner filed a Sur-Reply (Paper 43, "Sur-Reply"). A transcript of the oral hearing held on September 16, 2022, has been entered into the record as Paper 49 ("Tr.").

This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). For the reasons that follow, Petitioner has demonstrated by a preponderance of the evidence that the challenged claims are unpatentable.

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.

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[1] Patent Owner filed both confidential (Paper 27) and public, redacted (Paper 28) versions of the Patent Owner Response as well as certain exhibits, pursuant to the protective order entered by the Board (Paper 56). This Decision does not refer to any confidential information filed under seal.

B. Related Matters

The parties identify several related district court cases, including *Satco Products, Inc. v. The Regents of the University of California*, No. 2:19-cv-06444 in the Eastern District of New York ("the Satco Litigation"). Pet. 2–3; Paper 4, 2–3. Several other pending or terminated IPR proceedings challenge patents related to the '213 patent, including IPR2020-00579, IPR2020-00695, IPR2020-00780, IPR2021-00661, and IPR2021-00794.

In addition, several of the patents related to the '213 patent are involved in several investigations at the ITC. *Certain Filament Light-Emitting Diodes and Products Containing Same*, No. 337-TA-1172 (ITC) ("the 1172 Investigation"); *Certain Filament Light-Emitting Diodes and Products Containing Same (II)*, No. 337-TA-1220 (ITC) ("the 1220 Investigation") (collectively "the ITC Investigations"). The ALJ in the 1220 Investigation has issued a Markman Order (Ex. 1038) and an Initial Determination (Ex. 2009).

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":

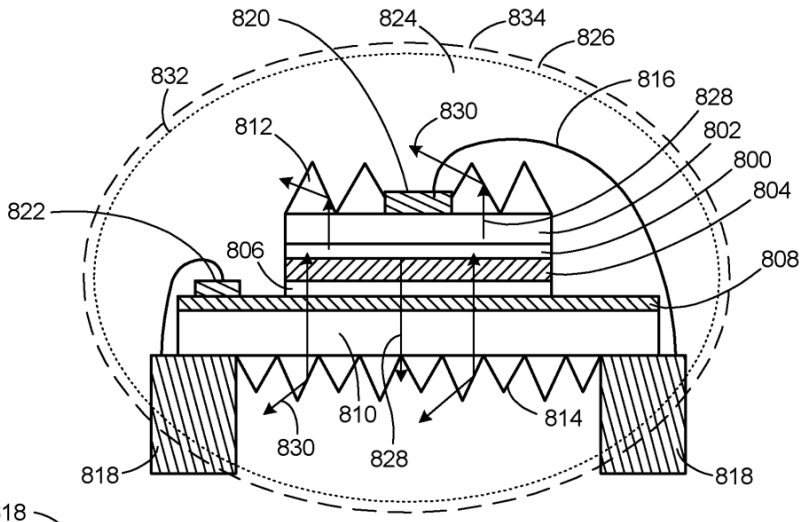


FIG. 8A

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":

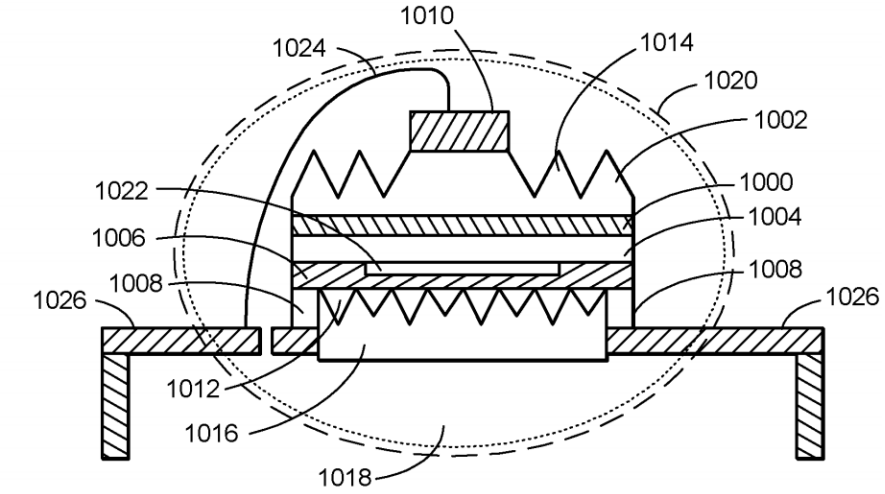


FIG. 10A

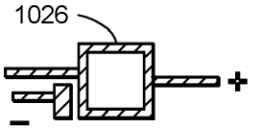


FIG. 10B

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 14:66–67, 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 '213 patent (reproduced below) depict an LED structure "according to the preferred embodiment of the present invention":

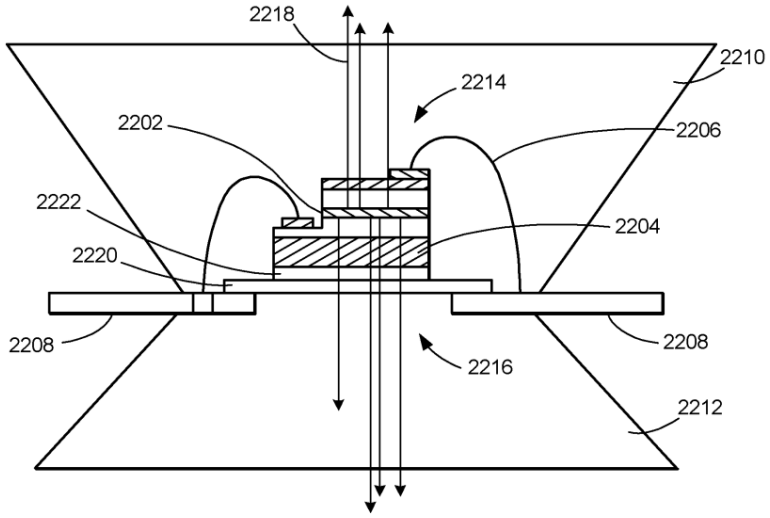


FIG. 22A

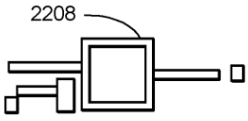


FIG. 22B

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. §[2]	Basis
1, 2	103(a)	Nakamura-959[3], Nakamura-949[4]
1	102	Tanda[5]
1	103(a)	Yamazaki[6], Schubert[7]
1	103(a)	Yamazaki, Schubert, Uemura[8,9]

[2] 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 versions of the statutory bases for unpatentability.

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

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

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

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

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

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

[9] 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. §[2]	Basis
1	103(a)	Yamazaki, Schubert, Han[10]
1	103(a)	Yamazaki, Schubert, Feldman[11]
2	103(a)	Tanda, Tadatomo[12,13]
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.

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

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

[12] 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.

[13] 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 declarations of Russell D. Dupuis, Ph.D. (Ex. 1035) and Takao Miyano (Ex. 1048) in support of its arguments. Patent Owner submits the declarations of E. Fred Schubert, Ph.D., M.S. (Ex. 2112[14]), Steven P. DenBaars, Ph.D. (Ex. 2110[15]), and Sherylle M. Englander (Ex. 2109[16]) 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. 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* PO Resp. 9–25. 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 Patent Owner is correct and the effective filing date is December 11, 2006, several of Petitioner's asserted references—namely Nakamura-959, Nakamura-949, and Tanda—would not qualify as prior art. *See* Ex. 1004 (published June 26, 2008); Ex. 1005 (published June 26, 2008); Ex. 1006 (filed Dec. 14, 2006). In addition, because the 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-AIA

[14] Exhibit 2112 is a redacted version of Exhibit 2034.

[15] Exhibit 2111 is a redacted version of Exhibit 2105.

[16] Exhibit 2019 is a redacted version of Exhibit 2108.

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

Because, as discussed below, we find that Petitioner has shown by a preponderance of the evidence that claims 1 and 2 of the '213 patent would have been obvious, respectively, over the combined disclosures of Yamazaki and Schubert, and the combined disclosures of Yamazaki, Schubert, and Tadamoto, we need not decide if Nakamura-959, Nakamura-949, or Tanda qualify as prior art. Moreover, neither party asserts that the outcome of this case is affected by whether we apply the pre- or post-AIA version of 35 U.S.C. § 103. Thus, we do not address this issue further.

III. 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 Pharms. 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* PO Resp.

We have reviewed Petitioner's proposal and find it reasonable and consistent with the prior art, and apply it for purposes of this Decision. *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) (2022). 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).

For purposes of the Institution Decision we agreed with the parties that no particular claim term need be construed. Inst. Dec. 26–27. In post-institution briefing, however, the parties disagree over the proper construction of several claim terms. First, the parties disagree over whether the term "phosphor" includes "fluorescent material" as disclosed in Yamazaki. PO Resp. 26–28; Reply 1–4; Sur-Reply 1–5. Second, the terms "sapphire" and "molding" become relevant when analyzing secondary considerations of non-obviousness. PO Resp. 6–8; Reply 29–30; Sur-Reply 26–27. However, because we adopt Petitioner's construction of the term

"sapphire," which is determinative of the secondary consideration issue, we need not construe the term "molding." We, therefore, address below the construction of the terms "phosphor" and "sapphire."

The 1220 Investigation addressed each of these two terms. In the Markman order, the ALJ construed the term "sapphire" (as recited in the related patents) as having the "plain and ordinary meaning, which is single crystal aluminum oxide." Ex. 1038, 9–11, 16–17; PO Resp. 6. According to Patent Owner, this construction has been affirmed by the Commission and Patent Owner is not appealing the construction of the term to the Federal Circuit. PO Resp. 6 n.1; Tr. 6:13–20, 39:1–16.

Although the Markman Decision of the 1220 Investigation did not address the term "phosphor," the Initial Determination stated that Yamazaki's fluorescent material discloses the phosphor recited by the claim at issue because "the fluorescent material will emit white light when 'excited by blue light,' just like the phosphor recited in claim 1" of the related patent, U.S. Patent No. 9,240,529. Ex. 2009, 92.

Neither party has argued that the terms "phosphor" and "sapphire," as recited in the claims of the '213 patent should be given a different construction than the same term as recited in the related patents at issue in the 1220 Investigation. PO Resp. 6–8, 26–28; Reply 1–4, 29–30; Sur-Reply 1–5, 26–27. In fact, both parties appear to agree that the terms in the '213 patent share a construction with those same terms in the related patents. PO Resp. 68 (stating that licenses that cover the '213 patent also cover those that are directly related to the '213 patent); Reply 29–30; Tr. 45:4–46:14.

1. Phosphor

Claim 1 recites "a molding comprising a phosphor." Ex 1003, 22:12. The Petition asserts that "Yamazaki discloses this limitation." Pet. 79. In particular, Petitioner quotes from Yamazaki highlighting that it uses the word "phosphor" in the context of discussing the transparent resin of the light-emitting device. *Id.* at 79–80 (quoting Ex. 1007 ¶¶ 34–35). Patent Owner, however, points out that this quotation is an error and that the official translation of Yamazaki proffered by Petitioner does not use the word "phosphor" and instead uses the words "fluorescent material." PO Resp. 26–28 (quoting Ex. 1007 ¶ 35). Petitioner concedes that the quotation of Yamazaki in its Petition was an inadvertent error. Reply 1–2. According to Petitioner, the quotation used in the Petition was from "a version of Yamazaki that was produced in related ITC cases." *Id.* (citing Ex. 1045 ¶¶ 34–35).

Based on this error, Patent Owner argues that "[n]either the Petition nor Dr. Dupuis allege or contend that the fluorescent material is phosphor or that it would be obvious to use phosphor as the fluorescent material," and therefore Petitioner has "failed to meet [its] burden of showing Yamazaki discloses 'a molding comprising phosphor.'" PO Resp. 28 (citing Pet. 79–80; Ex. 1035 ¶¶ 262–264); Sur-Reply 1. Further, Patent Owner asserts that Petitioner's attempts, in the Reply, to provide arguments and evidence that "ameliorate its mistake" are impermissible as outside the proper scope of a reply.[17] Sur-Reply 1–2 (citing Office Patent Trial Practice Guide, 77 Fed.

[17] Patent Owner also filed a Motion to Exclude the evidence submitted to support this argument. Paper 47. We address the arguments included in that motion below in Section IV.

Reg. 48,756, 48,774–75 (Aug. 14, 2012) ("Trial Practice Guide"); *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369–70 (Fed. Cir. 2016); 37 C.F.R. 42.23(b); *Qiagen N. Am. Holdings, Inc. v. HandyLab, Inc.*, 2021 WL 5024387 at *4 (Fed. Cir. Oct. 29, 2021)).

We do not agree with Patent Owner that Petitioner's response to this issue is impermissibly beyond the scope of the Reply. The disputed arguments and evidence respond to Patent Owner's argument that Petitioner has not shown that Yamazaki discloses a phosphor as recited in the challenged claims. *See Ericsson Inc. v. Intellectual Ventures I LLC*, 901 F.3d 1374, 1379–81 (Fed. Cir. 2018) (holding that the Board had abused its discretion where it "pars[ed] [the party's] arguments on reply with too fine of a filter" and noting that the reply "expands the same argument made in [the] Petition"); *Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F.3d 919, 925 (Fed. Cir. 2019) (determining that the purportedly "new argument" presented by the patent owner at oral argument "was not a new argument for patentability, but a clarification of its prior position in response to arguments raised in [petitioner's] reply").

Unlike the situation described in *Intelligent Bio-Systems* relied upon by Patent Owner, Petitioner, in its Reply, does not newly assert that a person of ordinary skill would have considered it obvious to use phosphor with Yamazaki. *Intelligent Bio-Sys.*, 821 F.3d at 1369–70. Instead, Petitioner reiterates its argument from the Petition that a person of ordinary skill would have understood Yamazaki to disclose using phosphor. Reply 3 ("Yamazaki discloses phosphors, as confirmed by dictionaries as well as Patentee's

expert's testimony and book"). We consider Exhibits[18] 1013, 1039, 1042 (39:9–42.5), 39:9–42:5, and 1049 to be responsive to Patent Owner's argument and thus proper to be relied upon in a reply. Upon examination, we also find some of this evidence to be highly probative and persuasive of Petitioner's position that a person of ordinary skill in the art would have found the terms phosphor and fluorescent material to be interchangeable.

First, Petitioner points to a definition from Hawley's Chemical Dictionary describing phosphor as:

> A ***substance*** . . . that is capable of luminescence, i.e., of absorbing energy from sources such as . . . UV radiations . . . and emitting a portion of the energy in the UV, visible, or infrared. When the emission of the substance ceases immediately or in the order of 10^{+8} sec after excitation, the ***material is said to be fluorescent***.

Ex. 1049[19] (emphasis added by Petitioner). Patent Owner points out that this definition shows there is a difference between phosphorescence and fluorescence such that phosphorescence does not necessarily immediately cease emission. Sur-Reply 2 (citing Ex. 1049, 3 (defining "phosphorescence" as "[a] type of luminescence in which the emission of radiation resulting from excitation of a crystalline or liquid material occurs *after* excitation has ceased and may last from a fraction of a second to an

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[18] Petitioner also provides a declaration of Mr. Miyano discussing the Japanese translation of the word that resulted in the English word "fluorescent material" in the official version of Yamazaki. Ex. 1048. Because we find sufficient evidence in the record to show the English terms "fluorescent material" and "phosphor" are interchangeable, we do not rely upon, or otherwise address this evidence regarding the issue of translation.

[19] We address Patent Owner's motion to exclude this document below in Section IV.

hour or more.")). During the hearing, Petitioner's counsel agreed that the dictionary definition indicates that fluorescent material is a subset of phosphor. Tr. 18:3–15; *see also* Tr. 15:20–16:8. We also agree that this definition supports a finding that there is some overlap in the terms, but it does not, on its own, support a finding that a person of ordinary skill would understand the terms "fluorescent material" and "phosphor" to be interchangeable.

Second, Petitioner points to testimony from Dr. Schubert supporting its position that a person of ordinary skill in the art would use the two terms interchangeably. Reply 3 (citing Ex. 1042, 38:3–42:5; Ex. 1039, 3-2, 3-4). The testimony in question discusses a portion of the 3rd Edition of Dr. Schubert's textbook "Light-Emitting Diodes." Ex. 1039. In his testimony, Dr. Schubert concedes that his textbook characterizes the use of fluorescent material as using a phosphor. Tr. 40:23–41:4, 41:20–42:5. However, Patent Owner argues that because the textbook in question was published in 2018, its statements "have no bearing on the correct translation of Yamazaki or a [person of ordinary skill in the art (POSITA)]'s understanding over a decade earlier." Sur-Reply 4. We agree that, by itself, this testimony supports only a finding that, in 2018, a person of ordinary skill in the art would have used the terms fluorescent material and phosphor interchangeably.

Third, and most significantly, Petitioner points to Shimizu, a patent filed in 1999, as repeatedly referring to phosphor as a garnet-based fluorescent material. Reply 3 (citing Pet. 27; Ex. 1013, 10:16–13:50). We agree that Shimizu appears to use the two terms interchangeably. For example, Shimizu states that "[t]he phosphor is specifically garnet fluorescent material" and "the fluorescent material is preferably yttrium-

aluminum-garnet fluorescent material (YAG phosphor) activated with cerium." Ex. 1013, 10:17–30. Patent Owner does not dispute this reading of Shimizu, but argues instead that it is "impermissible to rely on an entirely different reference" in a Reply. *See* Sur-Reply 4–5 (citing *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015)).

For the same reasons discussed above, we do not agree that Petitioner's use of Shimizu is improper, but is instead a proper response to Patent Owner's argument that a person of ordinary skill in the art would not have understood Yamazaki to disclose phosphor. *Ariosa*, relied upon by Patent Owner, confirms that the Board should consider an exhibit "for what it show[s] about the background knowledge that a skilled artisan would have possessed." *Ariosa*, 805 F.3d at 1365 ("The Board's language on its face supports Ariosa's interpretation of what the Board meant—that the Board was declining to consider Exhibit 1010, even as evidence of the background understanding of skilled artisans as of January 2010, simply because the brochure had not been identified at the petition stage as one of the pieces of prior art defining a combination for obviousness. If that is what the Board meant, the Board erred. Art can legitimately serve to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness.").

The Petition relies on Shimizu to show such background understanding. Pet. 27. Specifically, the Petition states that conventional LEDs "were made using the III-nitride material system, with semiconductor layers formed on sapphire substrates and combined with YAG phosphors to efficiently generate white light output." *Id.* (citing Ex. 1013, 10:30–11:35). Thus, Shimizu is properly objective evidence supporting a finding that at

least as early as 1999, a person of ordinary skill in the art would have used the terms "phosphor" and "fluorescent material" interchangeably. Moreover, Dr. Schubert's textbook published in 2018 explicitly references Shimizu. Ex. 1039, 3-4. In this context, we find that Dr. Schubert's textbook and testimony indicate that a person of ordinary skill in the art, at the relevant time, would have understood the terms to be interchangeable.

Fourth, Petitioner points to the finding of the ALJ in the 1220 Investigation addressing this issue and stating "[t]he 'fluorescent material' in Yamazaki is a phosphor, even if the English translation of Yamazaki does not use that word. That fact is certain because Yamazaki teaches that the fluorescent material will emit white light when 'excited by the blue light,' just like the phosphor recited in claim 1." Reply 3–4 (quoting Ex. 2009, 92). We agree with Patent Owner that this evidence is not binding, but as it is consistent with the evidence of record, we find it has some persuasive weight in deciding this issue. *See* Sur-Reply 5.

Patent Owner does not provide evidence to support a contrary finding that a person of ordinary skill in the art at the relevant time would not have found the terms "fluorescent material" and "phosphor" to be interchangeable. *See* PO Resp. 26–28; Sur-Reply 1–5. In fact, Patent Owner does not appear to assert that this is the case. *See* Tr. 36:14–37:2 (stating that Patent Owner has not "taken a specific position" on the relationship between the two terms).

Accordingly, based on the evidence of record, we adopt a construction of "phosphor" as recited by the claims of the '213 patent that includes "fluorescent material."

2. Sapphire

Claim 1 recites a "sapphire plate" and a "sapphire growth substrate." Ex. 1003, 21:18–22:11. In the 1220 Investigation, the ALJ considered this term and adopted a construction "according to its plain and ordinary meaning, which is single crystal aluminum oxide." Ex. 1038, 11.

Patent Owner asserts the proper construction for "sapphire" is "crystalline aluminum oxide (Al_2O_3)." PO Resp. 6. According to Patent Owner "the ITC construction of 'sapphire' is too narrow" and "[a]ny sapphire, whether single-crystal or polycrystalline, can serve as the sapphire plate." *Id.* Patent Owner characterizes this definition as "the plain and ordinary meaning." *Id.* at 7. Petitioner, on the other hand, urges us to adopt the construction from the 1220 Investigation, which Petitioner also characterizes as "the plain and ordinary meaning." Reply 29; Tr. 5:20–6:6.

The '213 patent does not explicitly define the term "sapphire," "sapphire plate," or "sapphire substrate." *See generally,* Ex. 1003. As evidence for its proposed construction, Patent Owner asserts that "[a]ny sapphire, whether single-crystal or polycrystalline, can serve as the sapphire plate because both crystalline forms are capable of extracting light from the LED chip." PO Resp. 6. To support this statement, Patent Owner points to language in the '213 patent stating that "transparent plate 2220 may be comprised of glass, quartz, sapphire, diamond or other material transparent for the desired emission wavelength, wherein the transparent glass plate 2220 effectively extracts the light 2218 emitted from the LED 2200 to the shaped optical element 2212." *Id.* at 7 (citing Ex. 1003, 20:35–40). This language, however, simply confirms that the transparent plate must be comprised of material transparent to light, and it does not support Patent

Owner's assertion that a person of ordinary skill in the art would understand that any sapphire, whether single-crystal or polycrystalline, meets this limitation. Patent Owner also points to deposition testimony of Dr. Dupuis allegedly agreeing that the sapphire plate of the '213 patent can be polycrystalline as long as it is transparent. *Id.* (citing Ex. 2016, 54:13–25); *see also* Sur-Reply 26 (citing Ex. 2016, 55:1–56:2). However, Dr. Dupuis explicitly states that in the context of electronics, the term "sapphire" "generally means single-crystal, pure alumina [Al_2O_3] in high-quality crystalline form." Ex. 2016, 55:1–8. He adds that he prefers to call polycrystalline Al_2O_3 "alumina" and "obviously someone who's designing an LED wants to get the most light out of it; so that would probably be single-crystal sapphire." *Id.* at 55:9–20. Thus, we understand Dr. Dupuis' testimony to be that, although sapphire can, in some contexts, include polycrystalline Al_2O_3, the person of ordinary skill in the art would understand, in the context of the '213 patent, that sapphire refers to single-crystal Al_2O_3. This testimony does not support Patent Owner's proposed construction.

To support its more narrow proposed construction, Petitioner points to testimony by Dr. DenBaars created for the 1172 Investigation stating "polycrystalline and aluminum oxide is not considered sapphire." Reply 29 (citing Ex. 1046, 271:2–12). In addition, Petitioner points to testimony of Dr. Schubert created for the 1172 Investigation stating "[s]ingle crystal [Al_2O_3] is referred to as sapphire, and polycrystalline [Al_2O_3] doesn't have really a special name, but it's just polycrystalline alumina." Ex. 1047, 191:2–5. We only have excerpts of this testimony and it was created for another proceeding, which affects the amount of weight we give it.

However, even giving this evidence minimal weight, it does support Petitioner's position as it is consistent with all the other evidence of record, including Dr. Dupuis' testimony.

Moreover, the ALJ in the 1220 Investigation noted that "the parties agree that in the context of 'sapphire growth substrate,' sapphire must mean single crystal structures." Ex. 1038, 10. Although we agree with Patent Owner that "the evidence the ITC relied on for its construction is not of record" in this case, Patent Owner has not sufficiently explained the apparently differing positions it has taken in this proceeding as compared to the 1220 Investigation. Tr. 39:17–43:22. In fact, Patent Owner appears to agree, in this proceeding, that at least the sapphire growth substrate must be single crystal aluminum oxide. *Id.* at 43:14–15 (Patent Owner's counsel stating "[m]y understanding is that the sapphire growth substrate does need to be single crystal aluminum oxide"). Moreover, as mentioned above, Patent Owner concedes that the Commission has affirmed the ALJ's construction of sapphire and Patent Owner has not appealed that decision. PO Resp. 6; Tr. 39:1–16, 41:10–11.

Accordingly, the record evidence supports Petitioner's proposed construction of sapphire as recited in the '213 patent and we adopt this construction—"single crystal aluminum oxide."

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 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." 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 non-obviousness, i.e., secondary considerations. *See Graham*, 383 U.S. at 17–18.

D. Grounds Based on Yamazaki and Schubert

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. Petitioner also contends that claim 2 is unpatentable because its subject matter would have been obvious over the combined disclosures of Yamazaki, Schubert, and Tadatomo. *Id*. at 6, 87–89.

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]

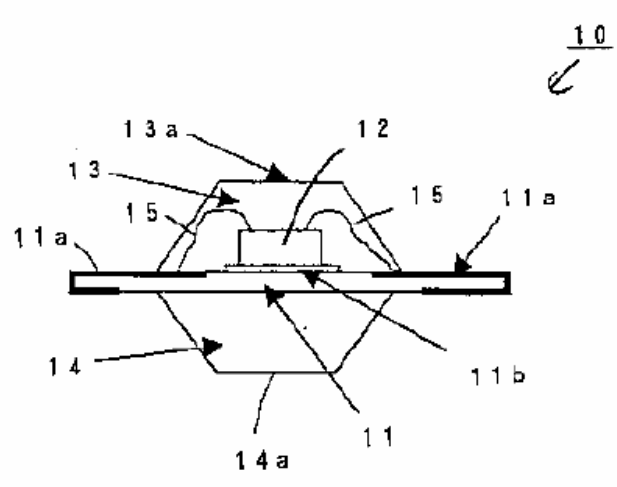


Figure 1 of Yamazaki depicts LED 10 with light-emitting chip 12 that is mounted on chip substrate 11, "a first resin molding portion 13 that is formed so as to cover the light-emitting chip 12 and also the entirety of the surface of the chip substrate 11," and "a second resin molding portion 14 that 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-brightness blue and green LEDs." Ex. 1008, 176.[20] Schubert also states that sapphire and SiC substrates are "commonly used." *Id.*

[20] 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.

3. 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. 1012, 243. It discusses improving the performance and reliability of LEDs by using a patterned sapphire substrate. *Id.* at 243–44.

4. 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.*

a. "a light bulb, comprising at least one light emitting device, the at least one light emitting device each further comprising:"

Petitioner asserts that "the parties agree that the preamble is not limiting." Pet. 72. Patent Owner does not appear to dispute this contention. *See* Sur-Reply 13 ("The Petition concedes that the 'light bulb' preamble is not limiting."); Ex. 2112 ¶ 78 (Petitioner's expert stating that "I have been asked to assume that the preamble of claim 1 is not limiting"). Moreover, Patent Owner does not dispute that Petitioner has satisfied its burden of showing obviousness for purposes of the preamble. *See generally* PO Resp. For purposes of this Decision, we presume the preamble is not limiting and do not further address this portion of the claim.

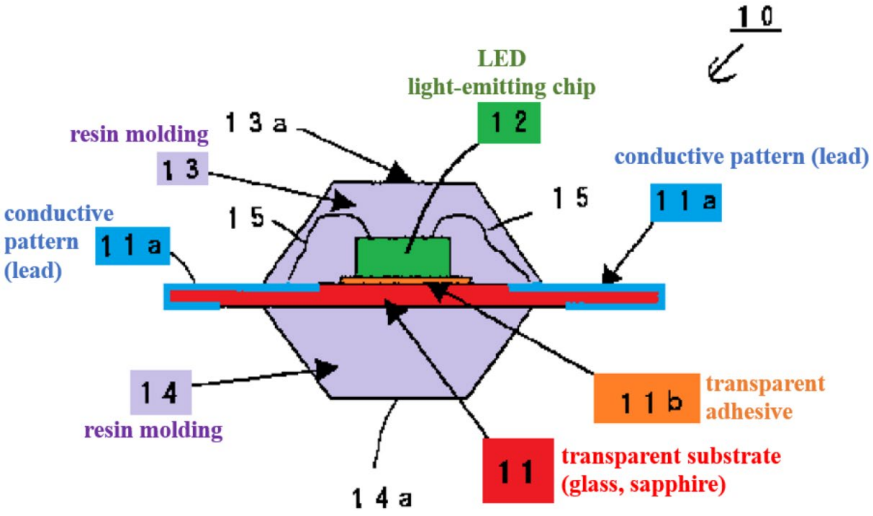
b. "a sapphire plate"

Petitioner asserts that Yamazaki discloses "a sapphire plate" as recited by claim 1. Pet. 73–74 (citing Ex. 1007, Fig. 1, ¶¶ 25–26; Ex. 1035 ¶¶ 243–245). We agree that Yamazaki's disclosure that "chip substrate 11 is structured as a flat chip substrate made from a transparent material, such as, for example, transparent glass, sapphire, SIC, or the like" discloses a sapphire plate as recited by claim 1. Ex. 1007 ¶ 26. Patent Owner does not dispute that Yamazaki discloses this limitation. *See generally* PO Resp.; Tr. 12:16–13:8.

c. The cathode/anode limitation

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." Pet. 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):



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." *Id.* (citing Ex. 1017 Figs. 3–4, 10; 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* PO Resp. 28–35. 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 29 (citing Ex. 1007; Ex. 2112 ¶¶ 159–160).

Patent Owner 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 29–33. 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 30 (citing Ex. 2112 ¶ 167). In addition, according to Patent Owner, Figure 3 does not show "separate [T-shaped] conductive patterns on the bottom surface of the chip substrate 11." PO Resp. 31. Instead, Dr. Schubert testifies that a person of ordinary skill in the art would understand the T-shaped portions in this figure "are the conductive pattern 11a on the top surface that are visible through the chip substrate 11, which can be 'transparent glass.'" Ex. 2112 ¶ 166. Dr. Schubert bases this conclusion on the fact that "both T-shaped parts of the electrically conductive pattern 11a" have a portion "extending towards the chip mounting region 11[c]," which a person of ordinary skill in the art would understand "provide[s] a bonding wire landing area to electrically connect the LED chip 12 to the electrically conductive pattern 11a via the bond wires 15." *Id.* ¶ 168. According to Patent Owner, there would be no reason for this extension on the bottom surface of the chip shown in Figure 3 "because the LED chip 12 is on the

opposite side." PO Resp. 31 (citing Ex. 2112 ¶ 169). Patent Owner adds that Figures 2 and 3 show "conductive patterns 11a" as having "the same size and shape on the top and bottom surfaces of the chip substrate 11," but Figure 1 shows these patterns as "having a different size/position." *Id.* at 32. According to Patent Owner, "[t]his inconsistency" would lead a person of ordinary skill in the art "to believe that the conductive pattern 11a is only on the top surface of the chip substrate 11." *Id.* at 33 (citing Ex. 2112 ¶ 171).

We do not agree with Patent Owner's characterization of Yamazaki's disclosure. First, we find that Yamazaki's Figure 1 plainly 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. In fact, the lines depicting 11a are bolded—the only bolded feature shown in *any* of the four figures of Yamazaki—in such a way as to appear to emphasize the wrap-around nature of the pattern. *See* Ex. 1007, Figs. 1–4. Similarly, we find that an ordinarily skilled artisan would have understood that the conductive pattern at one edge of the plate corresponds to a cathode and the other to an anode. *See id.* ¶¶ 64, 146, 221, 246; Ex. 2007, 169:12–20.

Second, we do not agree with Patent Owner that Figures 2 and 3 would lead a person of ordinary skill in the art to ignore the plain disclosure of Figure 1. Dr. Schubert agrees that Figures 1 and 2 of Yamazaki "are different views of the same device." Ex. 2112 ¶ 162. And we do not find the small gap in between pattern 11a and the edge of the chip shown in Figures 2 and 3 negates the plain disclosure of patterns 11a wrapping around the edges of chip substrate 11 in Figure 1. Further, even assuming that Figure 3 does not show conductive pattern 11a on the bottom surface of chip

substrate 11, we do not agree with Patent Owner's conclusion that a person of ordinary skill in the art would make the leap that Figure 1, therefore, does not disclose conductive pattern 11a wrapping around the edge of chip substrate 11.

Patent Owner further asserts that even if Petitioner were correct that the electrically conductive patterns 11a wrap around the edges of the chip substrate 11, "Yamazaki does not disclose how the electrically conductive patterns 11a are formed." PO Resp. 33 (citing Ex. 2112 ¶ 173). According to Patent Owner, a person of ordinary skill in the art "would understand that the electrically conductive patterns 11a are deposited or etched (and therefore do not structurally support the substrate 11)." *Id.* (citing Ex. 2112 ¶¶ 172–176; Ex. 2018, 3; Ex. 2019, 3–4).

Patent Owner points out that Figure 1 is not necessarily drawn to scale and "the thickness of the patterns 11a are similar to the thickness of the transparent adhesive agent 11b," which Yamazaki teaches "is spread thinly" and a person of ordinary skill would understand is "on the order of 1-10 microns thick." *Id.* at 34 (citing Ex. 2112 ¶¶ 178–181). According to Patent Owner, the word "pattern," as used in Yamazaki's "electrically conductive pattern 11a," would "signal" to a person of ordinary skill in the art that "a patterning process was involved" and "would have been understood by those skilled in the art as the process of forming metal traces either by photolithography followed by etching or a selective deposition (e.g., plating) process." Ex. 2034 ¶ 175. However, although Patent Owner points to dictionary definitions of the term "pattern," Patent Owner does not point to any objective evidence that a person of ordinary skill in the art would have understood the use of the term as a label, in this context, to require any

particular type of manufacture. *See* PO Resp. 33–35. Moreover, Patent Owner itself uses several phrases to refer to element 11a including both "pattern" and "leads." *See, e.g.*, PO Resp. 29 ("Fig. 2 illustrates a gap between the edge of the chip substrate 11 and the electrically conductive leads 11a"). Therefore, we do not agree with Patent Owner that the use of the word "pattern" is dispositive of the way this element would be manufactured. Patent Owner also asserts that "[d]epositing/etching a thin metal file, on the other hand, would have been simpler and would allow for commercially viable manufacturing." PO Resp. 37–38 (citing Ex. 2112 ¶¶ 185–200).

We agree that Yamazaki lacks detail about the structure and manufacture of elements 11a. *See, e.g.*, Ex. 1007 ¶¶ 26, 31–32. However, 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). 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).

The record supports a finding that a person of ordinary skill in the art would have understood that at the relevant time, both stamping j-leads and depositing/etching were conventional methods for creating metal leads. Petitioner points to evidence that typical LED packages with similar leads as those shown in Figure 1 of Yamazaki used j-leads bent around the package body in the early 1990's. Reply 5–6 (citing Ex. 1040, 14–15); *see also*

Ex. 1010; Ex. 1011; Ex. 1012.[21] Patent Owner does not dispute that j-leads were a conventional method of creating such leads. *See* PO Resp. 28–41. And, as discussed above, we agree that Figure 1 emphasizes the thickness of element 11a in relation to chip 11 and, thus, a person of ordinary skill in the art would have understood Yamazaki to teach the use of relatively thick j-lead metal leads that provided structural support. Ex. 2034 ¶ 246. We do not agree with Patent Owner that this conclusion rests on Figure 1 being "drawn to scale." *See* PO Resp. 34. Instead, although we agree that Yamazaki's figures do not define the precise proportions of the elements, we also note that Yamazaki emphasizes elements 11a in bold, indicating the elements' thickness relative to other portions of Figure 1.

Moreover, nothing in Yamazaki or in the claims of the '213 patent requires that the disclosed device be created using the most efficient high-volume manufacturing method. *See* Ex. 2112 ¶¶ 185–200 (explaining that depositing/etching would be the most suitable for "high-volume manufacturing"). And, therefore, we do not find Dr. Schubert's testimony relevant to whether a person of ordinary skill in the art would have understood Yamazaki to teach elements 11a as j-leads. In fact, Dr. Schubert does not support with objective evidence his conclusion that "it would be difficult or impossible to establish intimate contact between the transparent plate and metal lead." *See id.* ¶ 199. Given the apparent disclosure to the

[21] Although Uemura, Han, and Feldman, were not explicitly included in this ground, we find that these references, filed before the effective filing date of the '213 patent, are record evidence of the knowledge of a person of ordinary skill in the art would understand. *See* Ex. 1009; Ex. 1010; Ex. 1011.

contrary in his own textbook (*see* Ex. 1040, 14–15), and the equivocation and imprecision inherent in the phrase "difficult or impossible," we give this testimony very little weight.

Finally, we do not agree with Patent Owner's argument that Yamazaki is "non-enabling prior art" because it does not provide detail about "what material its electrically conductive patterns 11a are made of, the thickness of those patterns or how they are made." PO Resp. 39–41. According to Patent Owner, this lack of detail would have made it "difficult or impossible to achieve the bending radius of the metal leads required to establish the intimate contact needed between the transparent plate and metal leads shown in Yamazaki." *Id.* at 41 (citing Ex. 2112 ¶¶ 188–200). However, the evidence of record supports a finding that "typical" LED packages similar to those disclosed by Yamazaki were manufactured using j-leads in the early 1990s. Ex. 1040, 14–15. As for Dr. Schubert's testimony to the contrary, for the reasons discussed above, we give this testimony very little weight. *See* Ex. 2112 ¶¶ 185–200.

d. "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"

Petitioner asserts that Yamazaki in view of Schubert discloses this limitation ("the sapphire growth substrate limitation"). Pet. 76–78 (citing Ex. 1007 ¶¶ 12, 19, 26–27, 31; Ex. 1008, 149–150; Ex. 1035 ¶¶ 248–261). Specifically, Petitioner points to Yamazaki's disclosure of LEDs having a "known configuration," which are configured to emit "blue light," and Schubert discloses that "it was well-known to a POSITA that conventional

blue LEDs were III-nitride-based LEDs that commonly included sapphire growth substrates." *Id.* at 76–77 (citing Ex. 1007 ¶ 27; Ex. 1035 ¶¶ 248–249).

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 provides testimony supporting Petitioner's position. *See* Ex. 1035 ¶¶ 237–238, 248–251 (citing Ex. 1007 ¶¶ 27, 36; Ex. 1008, 166). Petitioner concludes that a person of ordinary skill "would reasonably expect and understand Yamazaki's device in view of Schubert-2003 to be implemented using a blue III-nitride LED featuring a sapphire growth substrate." Pet. 77.

Petitioner adds that Yamazaki discloses that the LED is adhered to the sapphire plate by transparent adhesive 11b, which, in view of Schubert teaches "die-bonding the LED's sapphire growth substrate to a sapphire plate," and thus teaches "the sapphire growth substrate in mechanical communication with the sapphire plate." *Id.* at 77–78 (citing Ex. 1007 ¶¶ 12, 19, 26, 31; Ex. 1008, 149–150; Ex. 1035 ¶¶ 257–258). And Petitioner relies on Yamazaki as disclosing that the LED and transparent sapphire plate "are configured such that light emitted by the LED is extracted through the transparent plate." *Id.* at 78 (citing Ex. 1007, Fig. 1, ¶¶ 34–35, 38; Ex. 1035 ¶¶ 259–261).

Patent Owner argues that Petitioner has not met its burden of showing this limitation is taught or suggested by the combined disclosures of Yamazaki and Schubert because "Petitioner has only shown that it is *possible* to use a III-nitride LED comprising a sapphire growth substrate in Yamazaki." PO Resp. 42 (citing *InTouch Techs., Inc. v. VGo Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)). According to Patent Owner, by stating that "blue LEDs were III-nitride-based LEDs that commonly included sapphire growth substrates," Petitioner "confirms that not all blue LEDs are necessarily III-nitride LEDs comprising a sapphire growth substrate," and many materials could be used as a growth substrate and there were advantages to using these materials over sapphire. *Id.* at 42–43 (citing Ex. 2112 ¶¶ 214, 217, 220). Patent Owner adds that "[b]oth Dr. Dupuis and Dr. Schubert agree that it was known to remove the sapphire growth substrate from the LED chip prior to packaging." *Id.* at 43 (citing Ex. 2016, 71:25–72:3; Ex. 2112 ¶¶ 221–224).

In addition, Patent Owner asserts that Schubert "does not expressly disclose a III-nitride-based LED comprising a sapphire growth substrate." *Id.* at 44 (citing Ex. 2016, 53:7–12; Ex. 1035 ¶ 251). And, according to Patent Owner, "Petitioner fails to articulate *why* it allegedly would have been obvious to modify Yamazaki to include a III-nitride LED comprising a sapphire growth substrate in mechanical communication with the sapphire plate" given that other materials were available and "it was known to remove the sapphire growth substrate. *Id.* at 45.

Based on the complete record, Petitioner establishes by a preponderance of the evidence that an ordinarily skilled artisan would have found the sapphire growth substrate obvious in light of Yamazaki's

disclosure. 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"); Ex. 1008, 166 (discussing "commonly used sapphire and SiC substrates"). We credit Dr. Dupuis' testimony that is consistent with the prior art of record. Ex. 1035 ¶¶ 238, 248–251 (citing Ex. 1008, 166); Ex. 1007 ¶ 27; Ex. 1009, 1:10–17, 4:61–67; Ex. 1012, 243; Ex. 2013, 10:30–11:35.

We are not persuaded otherwise by the deposition testimony of Dr. Dupuis pointed to by Patent Owner. PO Resp. 44 (citing Ex. 2016, 53:7–12). This testimony confirms that Schubert does not explicitly discuss whether the sapphire growth substrate is included in an LED package. *Id.* (citing Ex. 2016, 53:7–12). However, Patent Owner does not dispute that sapphire growth substrates were commonly used (as confirmed by Schubert) or that a person of ordinary skill in the art would have reasonably expected a blue LED to include a sapphire growth substrate. *See* PO Resp. 42–43 (stating only that sapphire is one among several materials that could be used as a growth substrate); Sur-Reply 9–10 (same).

Petitioner is not required to show that the proposed combination would have been preferred over other alternatives. *Infineum USA L.P. v. Chevron Oronite Co. LLC*, No. 2020-1333, 2022 WL 3147683, at *6 (Fed. Cir. Aug. 8, 2022) ("We have rejected the notion that a patent challenger seeking to demonstrate obviousness must prove that a person of ordinary skill would have been motivated to select one prior art disclosure over another."); *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) ("[O]ur case

law does not require that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention."). Instead, the question is whether a person of ordinary skill in the art would have understood the disclosure of Yamazaki, in light of the disclosure in Schubert, to teach or suggest the sapphire growth substrate limitation. As discussed above, persuasive evidence in the record establishes that this is true.

Petitioner is also not required to show that Schubert *necessarily* discloses using a sapphire growth substrate. Petitioner does not cite Schubert to show that the prior art includes a limitation that Yamazaki lacks. *See* Pet. 70–71, 76–77. Petitioner instead cites Schubert to provide evidence of what a person of ordinary skill in the art would understand Yamazaki's disclosure to teach. *Id.* 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). In addition, we find that a person of ordinary skill in the art when reading Yamazaki's disclosure, without specifics of the material system used in its blue LED, would have looked to Schubert's disclosure of materials commonly used in a conventional blue LED. Ex. 1007 ¶¶ 27, 36; Ex. 1008, 166; Ex. 1035 ¶¶ 237–238, 250–251.

We also do not agree with Patent Owner that Petitioner was required to show that a person of ordinary skill in the art would not have removed the sapphire growth substrate prior to packaging. Patent Owner points to some evidence that such removal is possible. *See* Ex. 2016, 71:25–72:3 (Dr. Dupuis stating that "[i]n principle, [the sapphire growth plate] can be removed."); Ex. 2112 ¶¶ 221–224 (Dr. Schubert stating that a person of

ordinary skill "would have known that the sapphire growth substrate could be removed") (citing Ex. 1003, 11:57–59, 12:27–28). But Patent Owner does not direct us to any record evidence that this was common practice or that a person of ordinary skill in the art would understand the combined disclosure of Yamazaki and Schubert as teaching such removal. *See* PO Resp. 43–44.

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." PO Resp. 46 (citing 37 C.F.R. § 42.104(b)(2)). However, 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.

e. "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"

Petitioner asserts that Yamazaki discloses this limitation. Pet. 79–80 (citing Ex. 1007 ¶¶ 34–35; Ex. 1035 ¶¶ 262–264). The record supports Petitioner's assertion that "Yamazaki discloses a specific embodiment in which the top surface of its device includes a first portion of molding which comprises a phosphor such that white light is emitted therefrom" and "*both* the top and bottom molding portions may comprise a transparent resin mixed

with a phosphor, such that the device is surrounded by molding comprising phosphor for converting blue light into white light." *Id.* at 80; Ex. 1007 ¶¶ 34–35. Patent Owner does not dispute that Yamazaki discloses this limitation. *See generally* PO Resp.

5. Claim 2

Claim 2 depends from claim 1. Petitioner relies on Yamazaki and Schubert as applied to claim 1 for all the limitations inherited from that claim. Claim 2 also recites "wherein the sapphire growth substrate is a patterned sapphire substrate (PSS)." Petitioner turns to Tadatomo to show this limitation. Pet. 87–89. Petitioner points to Tadatomo's disclosure of a PSS "fabricated by standard photolithography and subsequent reactive ion etching (RIE), in which Cl_2 was used for the etching gas." *Id.* at 88 (citing Ex. 1012, Fig. 2, ¶¶ 244–245). Petitioner explains that a person of ordinary skill in the art would have been motivated to combine Tadatomo's teachings with those of Yamazaki/Schubert because "growing semiconductor layers on a [PSS] rather than a conventional sapphire substrate . . . reduces undesirable dislocation density and increases light extraction efficiency." *Id.* at 87 (citing Ex. 1012, Abs., 244–48, Figs. 2, 7). Dr. Dupuis's testimony supports Petitioner's assertions. *See* Ex. 1035 ¶¶ 289–291.

Patent Owner does not dispute that Tadatomo discloses a PSS as recited by claim 2. *See* PO Resp. 63. Patent Owner, however, argues that a person of ordinary skill in the art would not have combined Yamazaki with Tadatomo because Tadatomo discloses light emission in only one direction. *Id.* (citing Ex. 1012, 245, Fig. 7; Ex. 2112 ¶ 291). According to Patent Owner, because of this one-sided light emission, a person of ordinary skill in the art "would not understand that the features of [Yamazaki and Tadatomo]

would be combined." *Id.* Patent Owner adds that "Yamazaki does not discuss any problems or concerns with light extraction, including internal quantum efficiency or external quantum efficient that would lead a POSITA to look to Tadatomo." *Id.* at 64.

Based on the record, Petitioner establishes by a preponderance of the evidence, 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, 243; *see* Ex. 1035 ¶ 290 (quoting Ex. 1012, 243). 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. We credit this testimony as it is consistent with the disclosure of Tadatomo.

The record does not support Patent Owner's contention that there is a relevant distinction between Tadatomo's LEDs and Yamazaki's LEDs that would prevent the person of ordinary skill from applying the former's surface-roughening techniques to the latter. Although Dr. Schubert notes that Tadatomo "envisions light emission in only one direction," he does not explain in his testimony why this distinction would make a difference when it comes to surface roughening. *See* Ex. 2112 ¶¶ 291–292. Moreover, Dr. Schubert does not refer to objective evidence to support his conclusion that

"without more" a person of ordinary skill in the art would not understand that the features of the two references would be combined. *Id*. As discussed during Dr. Schubert's deposition regarding a related patent in IPR2020-00579, a person of ordinary skill in the art would have wanted to minimize internal reflections in LEDs, and would have known that techniques such as those described in Tadatomo would have reduced internal reflections. Ex. 1044, 87:21–91:6. And Patent Owner's argument is contradicted by objective evidence in the prior art that surface-roughening techniques are applicable to LEDs such as the ones disclosed by Yamazaki. Ex. 1012, 243. On balance, the record evidence supports Petitioner's position. We find that the combination of Yamazaki, Schubert, and Tadatomo teaches each limitation of claim 2 and that an ordinarily skilled artisan would have had reasons, with rational underpinning, to combine the references, and the skilled artisan would have had a reasonable expectation of success.

E. Objective Indicia of Non-Obviousness

Before reaching a conclusion about obviousness, we consider evidence concerning objective indicia of non-obviousness. *See Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1047–48 (Fed. Cir. 2016) (en banc). For such evidence to have substantial weight, "its proponent must establish a nexus between the evidence and the merits of the claimed invention." *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016). "[T]here is no nexus unless the evidence presented is 'reasonably commensurate with the scope of the claims.'" *Id*. (quoting *Rambus Inc. v. Rea*, 731 F.3d 1248, 1257 (Fed. Cir. 2013)). The patentee "bears the burden of showing that a nexus exists." *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999).

A rebuttable presumption of nexus arises "when the patentee shows that the asserted objective evidence is tied to a specific product and that product 'embodies the claimed features, and is coextensive with them.'" *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (quoting *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018)). Whether a rebuttable presumption of nexus arises "turns on the nature of the claims and the specific facts." *Teva Pharm. Int'l GmbH v. Eli Lilly & Co.*, 8 F.4th 1349, 1362 (Fed. Cir. 2021). Absent a presumption of nexus, the patentee may prove nexus by showing that the objective evidence resulted directly from "the unique characteristics of the claimed invention." *Fox Factory*, 944 F.3d at 1373–74; *see In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996).

Thus, the Board employs a two-step analysis in evaluating whether a patentee has established a nexus between the evidence concerning objective indicia of non-obviousness and the merits of the claimed invention. *See Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 33 at 32–33 (PTAB Jan. 24, 2020) (precedential). Initially, the Board considers whether the patentee has demonstrated that the "products are coextensive (or nearly coextensive) with the challenged claims," resulting in a rebuttable presumption of nexus. *Id*. at 33. Absent a presumption of nexus, the Board considers whether the patentee has demonstrated "a legally and factually sufficient connection" between the evidence and the claimed invention. *See Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019)*; Lectrosonics*, IPR2018-01129, Paper 33 at 33.

1. Long-Felt but Unsolved Need

Patent Owner contends that "[t]he '213 patent technology solved a long-felt, but unresolved need in the field." PO Resp. 65. According to Patent Owner, this evidence shows that, at the time of the invention, there was a need for more efficient LEDs that emit more light, but without the metal heat sink or mirrors used to dissipate the higher heat associated with these higher-power devices. PO Resp. 65 (citing Ex. 2112 ¶¶ 296–299). Patent Owner contends that the '213 patent "is a continuation of Dr. Nakamura's Nobel Prize winning work" of improving "the efficiency and light extraction from blue LEDs based on the inventive packaging technique that was not known in the art." *Id.* at 66 (citing Ex. 2112 ¶ 301).

As evidence of this contention, Patent Owner relies on testimony from its expert, Dr. Schubert (Ex. 2112 ¶¶ 296–301), a textbook written by Dr. Schubert (Ex. 2017), and an article published in 2004 for the "Third International Conference on Solid State Lighting" titled "Thermal Management of LEDs: Package to System" (Ex. 2106). PO Resp. 65–66. In his testimony, Dr. Shubert also relies on a 2002 article titled "Thermal Challanges [sic] in the Future Generation Solid State Lighting Applications: Light Emitting Diodes" (Ex. 2111[22]). Ex. 2112 ¶ 299.

Patent Owner does not address the nexus between the evidence offered to show that the '213 patent solved a long-felt, but unresolved need in the field and the merits of the challenged claims. *See* PO Resp. 67–68. First, Patent Owner has not shown a presumption of nexus because none of the cited evidence involves any particular product. Second, Patent Owner

[22] Exhibit 2111 is a redacted version of Exhibit 2105.

has not established that the any long-felt need resulted directly from the unique characteristics of the claimed subject matter. Other than a general statement that the technology addressed by the '213 patent is a continuation of Dr. Nakamura's prize-winning work (*see* Ex. 2112 ¶ 231), we see no evidence in the record that the subject matter recited by claims 1 and 2 of the '213 patent, itself, solved the need for a more efficient LED without a heat sink or mirrors. *See* PO Resp. 65–66; Sur-Reply 23–24.

2. Industry Skepticism and Praise

Patent Owner contends that "SSLEEC's[23] inventions were met with skepticism" and all but one of the ten member companies of SSLEEC initially turned down the opportunity to license the technology. PO Resp. 66–68. In addition, Patent Owner contends that "SSLEEC's inventions were also met with praise by a SLEEC [sic] member company," who "recognized the value of the '213 patented technology." *Id.* at 67.

As evidence of this contention, Patent Owner relies on testimony from its expert, Dr. Schubert (Ex. 2112 ¶¶ 302–308) and testimony from Dr. Steven P. DenBaars, Executive Director of SSLEEC since 2001 and one of the named inventors of the '213 patent (Ex. 2110). PO Resp. 67–68.

Patent Owner does not address the nexus between the merits of the challenged claims and the evidence offered to show that the '213 patent was the object of skepticism or praise. *See* PO Resp. 68–68. First, Patent Owner

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[23] SSLEEC stands for "Solid State Lighting & Energy Electronics Center," a collaborative center at the University of California Santa Barbara that "partners with industry leaders and academic researchers to advance solid state lighting and energy efficient power switching using wide-bandgap semiconductors." Ex. 2107 ¶¶ 4–5.

has not shown a presumption of nexus because none of the cited evidence involves any particular product. Second, Patent Owner has not established that the skepticism and praise resulted directly from the unique characteristics of the claimed subject matter. We see no evidence in the record that the subject matter recited by claims 1 and 2 of the '213 patent, itself, was the object of the skepticism or praise referred to by Dr. DenBaars. In fact, all of Dr. DenBaars's testimony refers not to claims 1 and 2 of the '213 patent, but more broadly to "the '213 Patent Family," which "includes the '213 patent and U.S. Patent Nos. 10,658,557, 10,593,854, 10,454,010, 8,294,166, 10,217,916, and 8,835,959, along with any future related patents." Ex. 2110 ¶¶ 10, 15–21. Patent Owner does not explain how the relied upon skepticism or praise relates to the claims of the '213 patent in particular. *See* PO Resp. 67–68; Sur-Reply 24–25.

3. Licensing

Patent Owner contends that "licenses to the filament LED portfolio have generated approximately $4,001,246 in revenue since June 2019, from 23 non-exclusive license agreements." PO Resp. 68. According to Patent Owner, these licenses cover products that practice the '213 patent and are evidence of non-obviousness. *Id.* at 68–69; Sur-Reply 25.

As evidence for this contention, Patent Owner relies on testimony from its expert Dr. Schubert (Ex. 2112 ¶¶ 309–331), testimony from Dr. DenBaars (Ex. 2110), and testimony from Sherylle M. Englander, Director of the Office of Technology and Industry Alliances ("TIA") at the University of California, Santa Barbara since 2005 (Ex. 2109). Ms. Englander's testimony identifies copies of the 23 license agreements in the record (Ex. 2038–Ex. 2080). Patent Owner concedes that the relied upon

license agreements "include additional patents" beyond the '213 patent, adding that "those patents are either directly related to the '213 patent in terms of priority or subject matter." PO Resp. 68.

Dr. Schubert testifies that "certain licensee products" at issue in the ITC Investigations practice claims 1 and 2 of the '213 patent. Ex. 2112 ¶¶ 312–331. However, Dr. Schubert's testimony relies on a broad construction of "sapphire" as "crystalline aluminum oxide (Al_2O_3)" (*id.* ¶¶ 312–314). As discussed above in Section III.B.2, we do not agree with Patent Owner's construction and, therefore, find this testimony irrelevant.[24] Patent Owner, therefore, has not shown a presumption of nexus because no evidence shows that the relied upon products are coextensive with the challenged claims. And because the relied upon license agreements include several patents, Patent Owner has not established that these agreements resulted directly from the unique characteristics of the claimed subject matter. *See Teva Pharms. Int'l GmbH v. Eli Lilly & Co.*, 8 F.4th 1349, 1363–64 (Fed. Cir. 2021) ("Here, given that 188 patents were licensed, the nexus between the license and the validity of any particular claim is rather tenuous to say the least. Thus, the Board was correct to require that Teva show something more than the mere existence of the license."); *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1358 (Fed. Cir. 2000) ("[T]he mere existence of [three licenses of the challenged patent that

[24] Dr. Schubert also testifies that even if we do not adopt Patent Owner's proposed construction of the term "molding," "the licensed products meet this limitation under the doctrine of equivalents." Ex. 2034 ¶ 322. However, because we also do not adopt Patent Owner's proposed construction of the term "sapphire," we need not address this alternate argument.

were part of larger licensing packages] is insufficient to overcome the conclusion of obviousness . . . ."); *Merck & Cie v. Gnosis S.P.A.*, 808 F.3d 829, 838 (Fed. Cir. 2015) (holding it reasonable to afford licensing agreements very little weight when they covered several patents other than the challenged patent because "[i]t is therefore difficult to determine the extent to which the licensing agreement was a result of the novel features in the [challenged] patent, as opposed to the other patents involved").

4. Commercial Success

Patent Owner contends that "[t]he commercial success of infringing filament LED products, including Petitioner's, demonstrates non-obviousness." PO Resp. 69. According to Patent Owner, "Petitioner's products practice, and are coextensive with, claims 1–2 of the '213 patent either literally or under the doctrine of equivalents." *Id.*

As evidence for this contention, Patent Owner relies on testimony from its expert Dr. Schubert (Ex. 2112 ¶¶ 333–343) and a spreadsheet showing Petitioner's inventory of its filament LED products during the ITC Investigations (Ex. 2113). According to Patent Owner, Petitioner's large amount of inventory and the products' value "confirms the commercial success of Satco's products." PO Resp. 70. Dr. Schubert also discusses several technical analysis reports for certain of Petitioner's products and claim charts "showing the location of each and every element" of claims 1 and 2 of the '213 patent of those products. Ex. 2112 ¶¶ 335–337 (citing Exs. 2099–2104).

Petitioner argues that, under its proposed constructions of "sapphire" and "molding," its products do not meet the claims. Reply 29–30 (citing Ex. 2009 (ITC finding that none of Petitioner's products infringe related

patents)). Petitioner adds that Patent Owner's doctrine-of-equivalents arguments fail to show nexus. *Id.* at 30 (citing Ex. 2009, 180–83 (ITC finding that Patent Owner had not shown infringement under the doctrine of equivalents). In addition, Petitioner argues that "there is no evidence of actual commercial success" because there is no evidence that Petitioner's product sales were a significant portion of the market share, noting that the ITC Investigations involved more than 3000 products sold by at least 15 different companies. *Id.* at 31.

We agree with Petitioner that Patent Owner has not shown that commercial success demonstrates non-obviousness. First, Patent Owner has not shown a presumption of nexus because, based on our adopted constructions of "sapphire," no evidence shows that the relied upon products are literally coextensive with the challenged claims.

As for Patent Owner's assertion that the doctrine of equivalents can be used to show that the products are coextensive with the challenged claims, we are skeptical. Patent Owner cites, as authority for this theory, only one district court case stating that "the commercial success of a product that infringes a patent claim under the doctrine of equivalents can inform whether the patent claim is obvious." PO Resp. 69 (quoting *Dome Pat., L.P. v. Rea*, 59 F. Supp. 3d 52, 84 (D.D.C. 2014). Even if we presume that the doctrine of equivalents does apply to a presumption of nexus and that the license agreements proffered by patent owner involve products covered by the challenged claims under the doctrine of equivalents, each of the 23 license agreements relied upon by Patent Owner include several patents, and, therefore, Patent Owner has not established that these agreements

resulted directly from the unique characteristics of the claimed subject matter.

Moreover, Patent Owner has provided analysis under the doctrine of equivalents for only 3 products (*see* Exs. 2100, 2102, 2104) out of the almost 4 pages of products listed in the proffered inventory of Petitioner and the 3000 products at issue in the ITC. *See* Exs. 2009, 2113. Although Dr. Shubert testifies that "Item Model No. S298876 is representative of [Petitioner's] other filament LED products with ceramic plates" and that "Petitioner stipulated during the ITC Litigation that the Item Model No. S298876 is representative of the other products for purposes of infringement, but that this stipulation was limited to ITC Litigation," we see no evidence supporting this statement in this record. Ex. 2112 ¶ 338.[25]

Further, even if we presume that Patent Owner has sufficiently shown nexus by doctrine of equivalents, we agree with Petitioner that the proffered 23 license agreements and inventory spreadsheet are not enough to show commercial success. Petitioner points out that at the ITC, more than 3000 products, sold by at least 15 different companies, were accused of practicing the patents at issue. Reply 31. Patent Owner does not indicate how many of those 3000 products are at issue here and provides claim charts for only 3 products. *See* Ex. 2100; 2102; 2104. We, therefore, have no way of determining whether these products are a large or negligible percentage of the total number of products sold or if the provided sales numbers are a significant portion of the relevant market. *Cable Elec. Prods., Inc. v.*

[25] We note that Dr. Schubert says "Model No. S298876 is representative," but that the products analyzed include a model "S29876." We assume this to be a typographical error.

Genmark, Inc., 770 F.2d 1015, 1026–27 (Fed. Cir. 1985) (finding gross sales numbers meaningless without evidence of market share). Although market share data is not required to show commercial success, here the products at issue are each sold at a very low price per unit. *See Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1377–79 (Fed. Cir. 2021); Ex. 2113.

Because of the low price per unit and the large numbers of products on the market, the inventory spreadsheet relied on by Patent Owner does not clarify whether the volume of these products sold by Petitioner is large enough to suggest that the products are commercially successful. Patent Owner does not provide any analysis of the raw numbers in the inventory or any context of the market in which these products are sold to make sense of these numbers. *See* PO Resp. 69–70; Sur-Reply 27. We, thus, find the bare numbers of products sold by Petitioner, without further analysis or context, to be a negligible showing of commercial success, and insufficient to overcome the other evidence considered in the *Graham* analysis. *See In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996) ("This court has noted in the past that evidence related solely to the number of units sold provides a very weak showing of commercial success, if any.").

5. Conclusion

For these reasons, although we have considered Patent Owner's evidence of objective indicia of non-obviousness, we accord it little weight, and do not find that it outweighs the countervailing evidence supporting a conclusion of obviousness.

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

Because we find that Petitioner has shown by a preponderance of the evidence that claims 1 and 2 of the '213 patent would have been obvious over the combined disclosures of Yamazaki, Schubert, and Tadatomo we need not decide if Petitioner has shown the same over the combined disclosures of Yamazaki, Schubert, Tadatomo and either Uemura, Han, or Feldman. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) (non-precedential) (recognizing that the "Board need not address issues that are not necessary to the resolution of the proceeding" and, thus, agreeing that the Board has "discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims").

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

Because we find that Petitioner has shown by a preponderance of the evidence that claims 1 and 2 of the '213 patent would have been obvious over the combined disclosures of Yamazaki, Schubert, and Tadatomo, we need not decide if Petitioner has shown the same over the combined disclosures of Nakamura-959 and Nakamura-949.

H. Grounds Based on Tanda

Because we find that Petitioner has shown by a preponderance of the evidence that claims 1 and 2 of the '213 patent would have been obvious over the combined disclosures of Yamazaki, Schubert, and Tadatomo, we

need not decide if Petitioner has shown Tanda anticipates claim 1 or the combination of Tanda and Tadatomo renders obvious claim 2.

IV. PATENT OWNER'S MOTION TO EXCLUDE EVIDENCE

Patent Owner moves to exclude evidence contained within Exhibits 1040, 1043, 1045–1049, 2115, and 2116, and portions of deposition testimony elicited from Dr. Schubert during his deposition of October 15, 2020 (Ex. 1042, 39:9–42:5). Paper 47. All the evidence that Patent Owner seeks to exclude relates to the term "phosphor" and Petitioner's attempt to respond to Patent Owner's pointing out of the misquote of Yamazaki used in the Petition. *Id.*

Exhibit 1040 is Chapters 31–34 of the textbook "Light-Emitting Diodes, 3rd ed.," by Dr. Schubert published in 2018.

Exhibit 1042, 39:9–42:5 is testimony elicited from Dr. Schubert during his deposition of March 30, 2022 regarding an excerpt of Ex. 1040 as it uses the terms phosphor and fluorescent material.

Exhibit 1043 is a "Transcript of March 11, 2021 Rule 30(b)(6) Video Deposition of Regents of University of California by Shuji Nakamura" from the 1220 Investigation. Exhibit 2115 is a redacted version of this transcript.[26]

Exhibit 1045 is the translation of Yamazaki that Petitioner alleges was produced in a related ITC case and was inadvertently used to create the misquote in the Petition.

[26] Patent Owner asserts that the parties have stipulated that Exhibit 1043 should be expunged because it contains protected material. Paper 47, 4 n.1. We, therefore, refer only to Exhibit 2115 in this Decision.

Exhibit 1046 is a "Transcript of December 12, 2019 Confidential Videotaped 30(b)(6) Deposition of Steven DenBaars." Ex. 1046. Exhibit 2116 is a redacted version of this transcript.[27]

Exhibit 1047 is a "Transcript of February 14, 2020 Confidential Videotaped Deposition of E. Fred Schubert, Ph.D."

Exhibit 1048 is the declaration of Mr. Takao Miyano. Attachment A of Exhibit 1048 is an excerpt from a Japanese dictionary with only the word "fluorescence" in English. Attachment B of Exhibit 1048 is an excerpt from a Japanese dictionary with only the phrase "fluorescent substance" in English. Attachment C of Exhibit 1048 is an except from "Kenkyusha's New Japanese-English Dictionary." Attachment D of Exhibit 1048 is an excerpt from "Webster's Third New International Dictionary."

Exhibit 1049 is page 870 of Hawley's Condensed Chemical Dictionary, 14th Ed. Ex. 1049.

A. Whether Exhibits 1040, 1045, 1047–1049, 2115, and 2116 Should Be Excluded as Improper New Evidence

Patent Owner asserts that each of these exhibits 1040, 1045, 1047–1049, 2115, and 2116 should be excluded because it is new evidence to make out a *prima facie* case that should have been presented with the Petition, namely "that Yamazaki discloses, *inter alia*, a 'phosphor.'" Paper 47, 3. Patent Owner adds that each of these exhibits were in the possession of Petitioner at the time the Petition was filed because they were involved in the 1220 Investigation. *Id.* at 3–4. And according to Patent Owner, "[t]here

[27] Patent Owner asserts that the parties have stipulated that Exhibit 1046 should be expunged because it contains protected material. Paper 47, 4 n.1. We, therefore, refer only to Exhibit 2116 in this Decision.

is no reason why Petitioner could not have obtained Exhibits 1048 and 1049 when it submitted the Petition." *Id.* at 4.

As discussed above, in Section III.B.1, we do not agree that Petitioner's response to the issue of whether the terms "phosphor" and "fluorescent material" are interchangeable is impermissibly beyond the scope of the Reply. In addition, Exhibit 2115 was also relied upon by Petitioner to respond to Patent Owner's argument regarding priority date. *See* Reply 20–22. And Exhibits 1047 and 2116 were also relied upon by Petitioner to support its proposed construction of "sapphire." *See* Reply 29. Patent Owner does not address these additional uses of the exhibits. *See* Paper 47, 3–4. Further, we note that we do not rely on Exhibits 1045 or 1048 in this Decision.

For these reasons we deny Patent Owner's motion to exclude Exhibits 1040, 1045, 1047–1049, 2115, and 2116 as improper new evidence.

B. Whether Portions of Exhibit 1042 Should Be Excluded Under Fed. R. Evid. 611

Patent Owner argues that we should exclude Dr. Schubert's testimony at 39:9–42:5 from the transcript of his deposition. Paper 47, 4–5. Patent Owner contends that the testimony was beyond the scope of the deposition because "Dr. Schubert offered no opinions or discussion in his declaration as to whether Yamazaki discloses a 'phosphor' or whether 'fluorescent' is interchangeable with 'phosphor.'" *Id.*

We find that Dr. Schubert's testimony provides highly probative evidence on how a person of ordinary skill in the art would have understood the disclosure of Yamazaki, an issue clearly relevant to this proceeding as explained in Section III.B.1 above. Moreover, Patent Owner had a fair

opportunity at Dr. Schubert's deposition to meet the evidence with redirect testimony, but chose not to use that opportunity. Ex. 1042, 84 (declining redirect); *See* 37 C.F.R. § 42.53(c) (allocating four hours for redirect examination of a witness presenting "uncompelled direct testimony"). Patent Owner also had the opportunity to submit argument responding to this evidence in its Sur-Reply. We, therefore, do not agree with Patent Owner that this evidence is outside the proper scope of a reply.

For these reasons we deny Patent Owner's motion to exclude the specified portions of Dr. Schubert's testimony.

C. Whether Exhibits 1045, 1048, and 1049 Should Be Excluded as Hearsay Under Fed. R. Evid. 801–807

Patent Owner argues that Exhibits 1045, 1048, and 1049 are out of court statements relied upon for the truth of the matter asserted and thus are inadmissible hearsay under Fed. R. Evid. 802 and should be excluded from evidence. Mot. 7–8. Patent Owner asserts that Exhibit 1045 "is being offered to show that the Japanese version of Yamazaki purportedly discloses a phosphor." *Id.* at 6.

Hearsay is limited to an out-of-court statement that a party offers in evidence to prove the truth of the matter asserted in the statement. Fed. R. Evid. 801(c). Patent Owner does not rely on Exhibit 1045 for the truth of the matter asserted. Rather, Petitioner offers the disclosures within Exhibit 1045 as evidence of the source of the misquote in its Petition. *See* PO Resp. 1–2; Paper 50, 8. Because Petitioner has not convinced us that Exhibit 1045 is being offered to prove the truth of the matter asserted, we deny Patent Owner's motion to exclude Exhibit 1045 as inadmissible hearsay.

Patent Owner also asserts that in his testimony, Mr. Miyano (Ex. 1048) relies "entirely on dictionary definitions from third-party sources," which are inadmissible hearsay. Paper 47, 8–9. In addition, Patent Owner asserts that paragraphs 6–8 of Exhibit 1048 "are based on attachments that themselves violate FRE 801–807, and therefore should be excluded." *Id.* at 9. *Phillips* makes clear that when used in an appropriate manner, dictionaries, such as Exhibit 1049, "are often useful to assist in understanding the commonly understood meaning of words and have been used both by our court and the Supreme Court in claim interpretation," and "judges are free to consult dictionaries and technical treatises." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1322 (Fed. Cir. 2005) (*en banc*).

We do not rely on Exhibit 1048 in this Decision.

For these reasons we deny Patent Owner's hearsay objections to Exhibits 1045, 1048, and 1049.

D. Whether Petitioner Has Failed to Authenticate Exhibits 1045 and 1048 as Required Under Fed. R. Evid. 901–902

Patent Owner argues that Exhibit 1045 should be excluded because Petitioner has failed to authenticate the exhibit as required under Fed. R. Evid. 901. Paper 47, 6. According to Patent Owner, Exhibit 1045 "does not fall within one of the self-authenticating exceptions." *Id.*

Similarly, Patent Owner argues that Mr. Miyano's declaration (Ex. 1048) should be excluded because it "relies on information that is neither authenticated nor self-authenticating." *Id.* at 10 (citing Fed. R. Evid. 901–902). Specifically, Patent Owner argues that printouts from websites, such as Attachments A and B to Exhibit 1048, have not been properly

authenticated and are not self-authenticating at least because they are only partially translated from Japanese. *Id.* at 10–11.

We note that a proponent's "burden of proof for authentication is slight." *Lexington Ins. Co. v. W. Pa. Hosp.*, 423 F.3d 318, 328 (3rd Cir. 2005). Under FRE 901, the proponent must make a showing "sufficient to support a finding that the item is what the proponent claims it is." Fed. R. Evid. 901(a).

As explained above, we do not rely on Exhibit 1048 and we find Exhibit 1045 to be sufficiently reliable for the purposes of showing the source of Petitioner's misquote in the Petition. For these reasons we deny Patent Owner's authentication objections to Exhibits 1045 and 1048.

E. Whether Exhibit 1048 Violates 37 C.F.R. § 42.63(a)–(e)

Patent Owner argues that Exhibit 1048 should be excluded because it includes "improper translations that were submitted without an affidavit attesting to their accuracy" and relies on attachments that were not filed as exhibits. Paper 47, 12–14.

As explained above, we do not rely on Exhibit 1048 for this Decision and, therefore, we deny Patent Owner's request to exclude it.

V. PETITIONER'S MOTION TO EXCLUDE EVIDENCE

Petitioner asserts that the Board should exclude portions of Exhibits 1034 and 2112 (collectively, "Dr. Shubert's Declaration"). Paper 48. All the evidence that Petitioner seeks to exclude relates to objective indicia of nonobviousness, which Petitioner alleges is "irrelevant and unreliable" because it does not properly show nexus. *Id.* These arguments, however, relate to how much weight the evidence should be credited with, not whether the evidence is admissible. We are not persuaded that exclusion of any

testimony on this issue is necessary under our rules or is needed to remedy possible prejudice to Petitioner.

Accordingly, we deny Petitioner's Motion to Exclude.

VI. CONCLUSION

Based on the full record, we determine that Petitioner shows by a preponderance of the evidence that claims 1 and 2 of the '213 patent are unpatentable.[28]

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2	103(a)	Nakamura-959, Nakamura-949[29]		
1	102	Tanda[30]		
1	103(a)	Yamazaki, Schubert	1	
1	103(a)	Yamazaki, Schubert, Uemura[31]		
1	103(a)	Yamazaki, Schubert, Han[32]		

[28] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding after the issuance of this Final Written Decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

[29] As described in the Decision, we do not address this ground.

[30] As described in the Decision, we do not address this ground.

[31] As described in the Decision, we do not address this ground.

[32] As described in the Decision, we do not address this ground.

1	103(a)	Yamazaki, Schubert, Feldman[33]		
2	103(a)	Tanda, Tadatomo[34]		
2	103(a)	Yamazaki, Schubert, Tadatomo	2	
2	103(a)	Yamazaki, Schubert, Uemura, Tadatomo[35]		
2	103(a)	Yamazaki, Schubert, Han, Tadatomo[36]		
2	103(a)	Yamazaki, Schubert, Feldman, Tadatomo[37]		
Overall Outcome			1, 2	

VII. ORDER

Accordingly, it is:

ORDERED that Patent Owner's Motion to Exclude is denied;

ORDERED that Petitioner's Motion to Exclude is denied;

ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has shown by a preponderance of the evidence that claims 1 and 2 of the '213 patent are unpatentable; and

FURTHER ORDERED that parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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[33] As described in the Decision, we do not address this ground.
[34] As described in the Decision, we do not address this ground.
[35] As described in the Decision, we do not address this ground.
[36] As described in the Decision, we do not address this ground.
[37] As described in the Decision, we do not address this ground.

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