

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NICHIA CORPORATION and
OSRAM OPTO SEMICONDUCTORS, INC.,
Petitioner,

v.

LIGHTING SCIENCE GROUP CORP.,
Patent Owner.

IPR2019-01260
Patent 7,528,421 B2

Before KEVIN F. TURNER, PATRICK M. BOUCHER, and
JOHN A. HUDALLA, *Administrative Patent Judges*.

BOUCHER, *Administrative Patent Judge*.

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

Nichia Corporation and OSRAM Opto Semiconductors, Inc.
(collectively, “Petitioner”) filed a Petition pursuant to 35 U.S.C. §§ 311–319
to institute an *inter partes* review of claims 1, 2, 6, and 10 of U.S. Patent No.
7,528,421 B2 (“the ’421 patent”). Paper 1 (“Pet.”). Lighting Science Group

Corp. (“Patent Owner”) filed a Preliminary Response. Paper 21 (“Prelim. Resp.”). Pursuant to our authorization, Petitioner filed a Reply and Patent Owner filed a Sur-Reply. Papers 23, 24. Applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we deny the Petition and do not institute an *inter partes* review.

I. BACKGROUND

A. The '421 Patent

The '421 patent “relates to packaged assemblies of light emitting diodes (LEDs) and, in particular, to LED assemblies packaged for surface mounting and high temperature operation.” Ex. 1001, 1:19–22. Versions of Figures 1A and 1B, modified with coloring added by Patent Owner, are reproduced below. Prelim. Resp. 6.

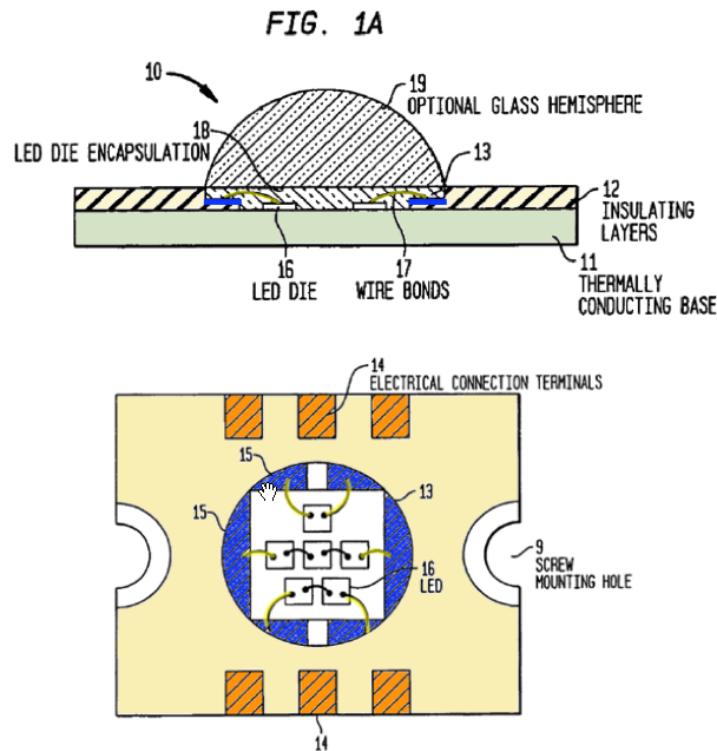


Figure 1A (top) and Figure 1B (bottom) respectively provide a cross-sectional and top view of a packaged LED assembly for high-temperature operation. Ex 1001, 2:63–65. The coloring added to the drawing by Patent Owner simplifies identification of the relevant components of the structure.

As illustrated in the drawings, LED assembly 10 includes thermally conducting base 11 (green) and one or more electrically insulating layers 12 (light yellow) overlying base 11 and defining surface cavity 13. *Id.* at 2:65–3:1. One or more electrical connection paths are disposed on the insulating layers 12. *Id.* at 3:1–3. “[E]ach electrical connection path includes a terminal 14 [(orange)], a connection pad 15 [(blue)], and connector paths (not shown) which connects each terminal 14 to its respective pad 15.” *Id.* at 3:3–6. One or more LED dies 16 are disposed within surface cavity 13 such that each LED die 16 is in thermal contact with base 11. *Id.* at 6–9. LED dies 16 are also electrically connected to respective connection pads 15 “such as, for example, by bonding wires 17 [(bright yellow)].” *Id.* at 3:17–20. LED dies 16 are sealed in surface cavity 13 and protected by filling cavity 13 within optically clear encapsulant 18. *Id.* at 3:26–29. Optical element 19, which may be a glass dome, may be attached overlying LED dies 16 using the adhesive properties of encapsulant 18 or a separate adhesive material. *Id.* at 3:30–33.

B. Illustrative Claim

Independent claim 1 is illustrative of the challenged claims and is reproduced below.

1. A LED assembly adapted for surface mounting and high temperature operation, the LED assembly comprising:

a thermally conducting base, wherein at least a portion of the thermally conducting base is substantially planar;

one or more electrically insulating layers overlying at least a portion of the planar portion of the thermally conducting base and defining a surface cavity, wherein the electrically insulating layers include one or more terminals;

one or more LED die disposed at least partially within the surface cavity, wherein the one or more LED die are in thermal contact with the planar portion of the thermally conducting base, and electrically connected to the one or more terminals of the one or more insulating layers,

wherein a bottom surface of the LED assembly includes a thermally conductive region in solderable thermal contact with the thermally conducting base, for spreading heat transmitted to the base from the one or more LED die; and

further comprising an LED assembly mount selected from the group consisting of an electrically insulated fastener and a solderable bonding pad.

Ex. 1001, 7:46–67.

C. Evidence

Petitioner relies on the following references:

Andrews	US 2004/0079957 A1	Apr. 29, 2004	Ex. 1008
Bogner	WO 02/084749 A2	Oct. 24, 2002	Ex. 1009 ¹
Yoganandan	US 2002/0163006 A1	Nov. 7, 2002	Ex. 1010

In addition, Petitioner relies on a Declaration by Phillip Wright, Ph.D.
Ex. 1003.

¹ Exhibit 1009 includes a copy of the original German reference and an English translation, with an affidavit by the translator attesting to the accuracy of the translation. Our citations are to the English translation.

D. Asserted Grounds of Unpatentability

Petitioner challenges claims 1, 2, 6, and 10 on the following grounds.
Pet. 5–6.

Claims Challenged	35 U.S.C. §²	Reference(s)
1, 2, 6, 10	102	Andrews
1, 2, 6, 10	103	Andrews
1, 2, 6, 10	102	Bogner
1, 2, 6, 10	103	Bogner, Andrews
1, 2, 6, 10	102	Yoganandan

E. Real Parties in Interest

Petitioner identifies Nichia Corporation, Nichia America Corporation, OSRAM GmbH, OSRAM Licht AG, OSRAM Opto Semiconductors GmbH, and OSRAM Opto Semiconductors, Inc. as real parties in interest.
Pet. 2. Patent Owner identifies only itself as a real party in interest.
Paper 5, 1.

F. Related Matters

Both parties identify the following matters as involving the '421 patent: (1) *Lighting Science Group Corp. v. Nichia Corp.*, No. 1:19-cv-01948 (N.D. Ga.); (2) *Lighting Science Group Corp. v. OSRAM GmbH*, No. 1:19-cv-00797 (D. Del.); (3) *Lighting Science Group Corp. v. Cree, Inc.*, No. 1:19-cv-00632 (E.D. Wis.); (4) *Lighting Science Group Corp. v. Leedarson Lighting Co., Ltd.*, No. 1:19-cv-01949 (N.D. Ga.); (5) *Lighting*

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the '421 patent was filed before March 16, 2013 (the effective date of the relevant amendment), the pre-AIA versions of §§ 102 and 103 apply.

Science Group Corp. v. Acuity Brands, Inc., No. 1:19-cv-00805 (D. Del.); (6) *Lighting Science Group Corp. v. Eaton Corp. plc*, No. 1:19-cv-00808 (D. Del.); (7) *Lighting Science Group Corp. v. Gen. Elec. Co.*, 1:19-cv-00806 (D. Del.); (8) *Lighting Science Group Corp. v. Lumileds Holdings B.V.*, No. 1:19-cv-00809 (D. Del.); (9) *Lighting Science Group Corp. v. MLS Co., Ltd.*, No. 1:19-cv-00798 (D. Del.); (10) *Lighting Science Group Corp. v. Signify N.V.*, No. 1:19-cv-00807 (D. Del.); and (11) *Certain Light Emitting Diode Products, Systems, and Components Thereof (I)*, Inv. No. 337-TA-1163 (ITC). Pet. 2–3; Paper 5, 2–3.

II. ANALYSIS

A. Legal Principles

To establish anticipation under 35 U.S.C. § 102, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). While the elements must be arranged in the same way as is recited in the claim, “the reference need not satisfy an *ipsissimis verbis* test.” *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832–33 (Fed. Cir. 1990). Identity of terminology between the anticipatory prior art reference and the claim is not required. Prior art references must be “considered together with the knowledge of one of ordinary skill in the pertinent art.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

A claim is unpatentable for obviousness under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are

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

Additionally, the obviousness inquiry typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)); see *In re Warsaw Orthopedic, Inc.*, 832 F.3d 1327, 1333 (Fed. Cir. 2016) (citing *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1360 (Fed. Cir. 2006)).

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. “The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v.*

³ The parties do not address objective indicia of nonobviousness, which accordingly do not form part of our analysis.

Nu-Star, Inc., 950 F.2d 714, 718 (Fed. Cir. 1991). The “person of ordinary skill in the art” is a hypothetical construct, from whose vantage point obviousness is assessed. *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). “This legal construct is akin to the ‘reasonable person’ used as a reference in negligence determinations” and “also presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan.” *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Petitioner asserts that the level of skill in the art is apparent from the cited art and that such a person “would have had at least a B.S. in mechanical or electrical engineering or a related field, and four years’ experience designing semiconductor—including LED—packages.” Pet. 11 (citing Ex. 1003 ¶¶ 31–33). Patent Owner does not dispute this articulation, which we adopt for this Decision. See Prelim. Resp. 8.

C. Claim Construction

For petitions filed after November 13, 2018, the Board uses “the same claim construction standard that would be used to construe the claim 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. § 100(b); see *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Petitioner proposes that the term “base,” recited in independent claim 1 as well as dependent claim 6, be construed to mean “support or foundation,” and that the phrase “integral part of,” recited in dependent claim 2, be construed to mean “a part of a

whole.” Pet. 20–24. Patent Owner contends that we “need not rule on Petitioners’ proposed claim constructions, because construction of those terms is not necessary in order to resolve the parties’ dispute.” Prelim. Resp. 8.

Although we agree with Patent Owner that resolution of the parties’ dispute does not require construction of “base” or “integral part of,” we find it necessary, in light of the parties’ arguments, to consider the meaning of a “thermally conductive region in solderable thermal contact with the thermally conducting base,” recited in independent claim 1. Neither party addresses this phrase as a matter of claim construction, but both parties implicitly proffer a proposed construction in their arguments. See Pet. 41–43; Prelim. Resp. 35–40. In particular, Petitioner takes the position that “the term ‘solderable’ does not mean that the ‘thermally conductive region’ is to be ‘solderable’ to the ‘thermally conducting base’; rather, ‘solderable’ requires the thermally conductive region to be ‘solderable’ *to another structure outside the assembly*.” Pet. 41–42. Conversely, Patent Owner contends that “the modifier ‘**solderable**’ in ‘solderable thermal contact’ . . . applies to the relationship between (1) the ‘thermally conductive region’ and (2) the ‘thermally conducting base.’” Prelim. Resp. 36.

First, we find that the plain meaning of the phrase supports Patent Owner’s proposal. The adjectives “solderable” and “thermal” are grammatically parallel in the phrase, and there is no apparent reason why those adjectives do not each equivalently modify the noun “contact,” such that the “contact” between the thermally conductive region and the thermally conducting base must be both “solderable” and “thermal.” See Prelim. Resp. 35–36 (Patent Owner asserting that “[t]his term plainly requires ‘*solderable*

thermal contact between a thermally conductive region and the **thermally conductive base**”).

Second, we find that the prosecution history of the ’421 patent also supports Patent Owner’s proposal. Although both parties cite the same relevant aspect of that prosecution history, they interpret it differently. See Pet. 41–42; Prelim. Resp. 36–39. When the application that matured into the ’421 patent was originally filed, independent claim 1 did not include the word “solderable,” but instead recited only that a bottom surface of the LED assembly include “a thermally conductive region in thermal contact with the thermally conducting base, for spreading heat transmitted to the base from the one or more LED die.” Ex. 1002, 21. After the Applicant successfully traversed an obviousness rejection based on a combination of U.S. Patent Nos. 5,847,935 (“Thaler”) and 6,565,239 (“Rizkin”), the Examiner rejected claim 1 as anticipated by U.S. Patent Publ. No. 2003/0189830 (Ex. 1011, “Sugimoto”). *Id.* at 109.

Sugimoto describes a light-source apparatus using an LED in which light-emission efficiency is improved to achieve greater light-output intensity, operational life, and mechanical strength. Ex. 1011 ¶¶ 1, 17. In responding to the anticipation rejection during prosecution to distinguish Sugimoto, the Applicant made two amendments to independent claim 1. First, the claim was amended to add the last limitation of the issued claim (“further comprising an LED assembly mount selected from the group consisting of an electrically insulated fastener and a solderable bonding pad”). Ex. 1002, 124. Second, the claim was amended to add the word “solderable” in the limitation at issue, thereby requiring that the “thermally conductive region [be] in *solderable* thermal contact with the thermally

conducting base” (emphasis added). *Id.* Both of these aspects of Applicant’s amendments were identified by the Examiner in the reasons for allowance as not disclosed by Sugimoto. *Id.* at 167.

Figure 17 of Sugimoto is reproduced below, modified with coloring added by Patent Owner. Prelim. Resp. 38.

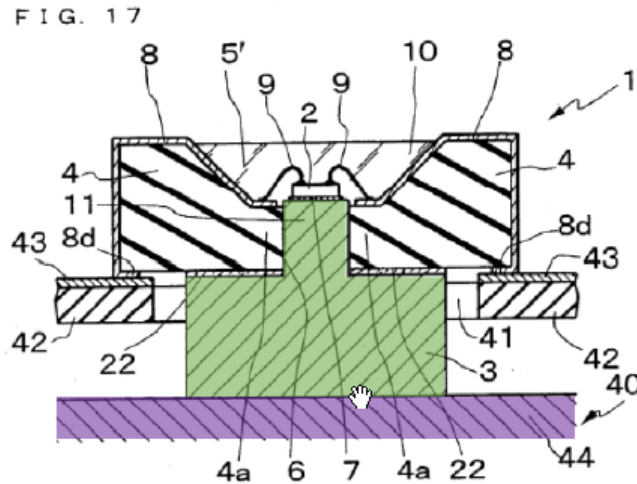


Figure 17 provides a cross-sectional view of an embodiment of a light source apparatus. Ex. 1011 ¶ 152. Although the Examiner relied on the embodiment illustrated in Figure 16 of Sugimoto in the rejection, the Applicant referred to Figure 17 as illustrating “the analogous thermal coupling,” contending that “radiator plate 3 [(green, corresponding to the recited “thermally conducting base”)] is *merely abutted* to radiating member 44 [(purple, corresponding to the recited “thermally conductive region”)].” Ex. 1002 133 (emphasis added).

Petitioner recognizes this reliance on Figure 17 of Sugimoto (and indeed, reproduces Figure 17 in its argument), without disputing that such reliance is appropriate. Pet. 41–42. In doing so, Petitioner asserts that in distinguishing between “solderable thermal contact” and mere abutment, “the Applicant made clear that . . . ‘solderable’ requires the thermally

conductive region to be ‘solderable’ *to another structure outside the assembly*.” *Id.* Petitioner’s expert, Dr. Wright, makes a similar statement. Ex. 1003 ¶ 51 (“I also noted that during prosecution, . . . the Applicant took the position that ‘solderable’ requires the thermally conductive region to be ‘solderable’ *to another structure outside the assembly*”); ¶ 161.

Neither Petitioner nor Dr. Wright explains how they reach such a conclusion from the Applicant’s prosecution argument, and we do not find that conclusion supported by the Applicant’s argument. Accordingly, we give little weight to Dr. Wright’s testimony on this point. *See* 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”). Rather, we agree with Patent Owner that the distinction made by the Applicant was between “solderable thermal contact” and abutment of structures within the LED assembly. *See* Prelim. Resp. 37–38 (“The patentee clearly identified the most ‘*analogous*’ structures as ‘radiator plate 3’ and ‘radiating member 44.’” (citing Ex. 1002, 133) (emphasis by Patent Owner)). “Thus, the addition of the limitation ‘solderable’ to ‘thermal contact’ was intended to distinguish Sugimoto on the basis that Sugimoto’s closest equivalent to the thermally conducting base (radiator plate 3) was *not* in *solderable* thermal contact with its closest equivalent to the thermally conducti[ve] region (radiating member 44).” *Id.* at 38.

Accordingly, we construe the modifier “solderable” in “solderable thermal contact” as applying to the relationship between (1) the “thermally conductive region” and (2) the “thermally conducting base,” as Patent Owner proposes.

D. Anticipation by Andrews

Petitioner challenges claims 1, 2, 6, and 10 as anticipated by Andrews. Pet. 31–41.

1. Overview of Andrews

Andrews describes an LED die package optimized for high-temperature operation of an LED die. Ex. 1008 ¶¶ 38–39. Figures 1B and 7B of Andrews, modified with coloring added by Petitioner (and with Figure 1B further modified by Petitioner’s removal of the drawing label and reference number 10), are reproduced below. Pet. 25.

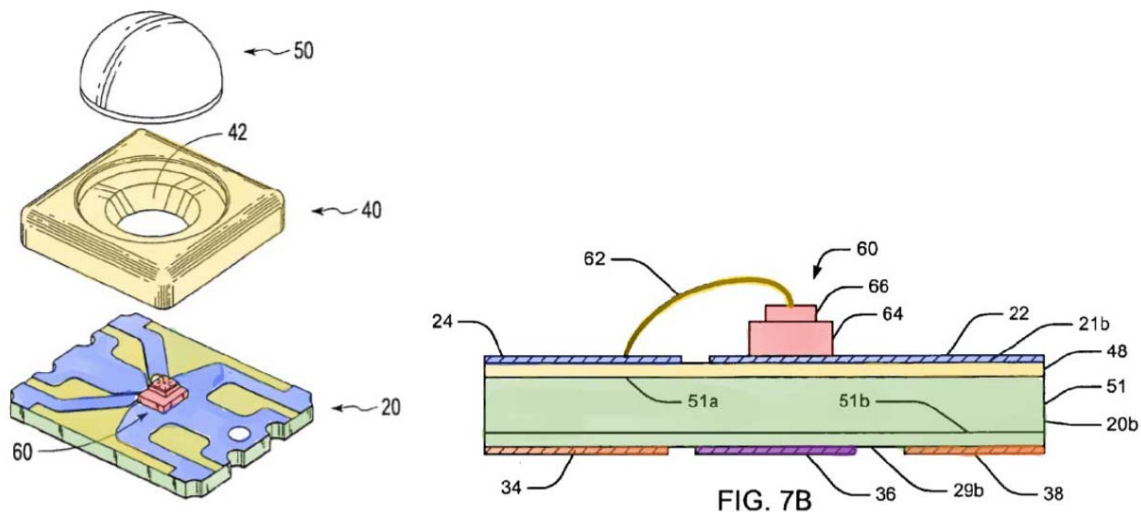


Figure 1B (left) is an exploded perspective view of a semiconductor die package, and Figure 7B (right) is a front view of a variant of the semiconductor die package. Ex. 1008 ¶¶ 17, 30. As shown in Figure 1B, the package includes bottom heat sink 20, top heat sink 40 (yellow), and lens 50. *Id.* ¶ 39. LED assembly 60 (pink), including LED die 66, is situated in a cavity within top heat sink 40. *Id.* ¶¶ 44, 68.

Figure 7B shows that bottom heat sink 20 includes thermally and electrically conductive plate 51 (green) and thermally conductive insulating film 48 (light yellow) formed on at least portions of a top surface of electrically conductive plate 51. *Id.* ¶ 66. Electrically conductive traces, such as electrical traces 22 and 24 (blue) may be provided, such as to function as a cathode and anode. *Id.* ¶¶ 67–68. Bottom heat sink 20 also has thermal contact pad 36 (purple) attached to a bottom side thereof, with contact pad 36 made of a material having high thermal conductivity to conduct heat away from LED die 66. *Id.* ¶¶ 40, 49. Solder pads 34 and bond pad 38 (both orange) are supported on the bottom side of bottom heat sink 20. *Id.* ¶¶ 71, 75.

2. Independent Claim 1

Petitioner provides a detailed mapping of disclosure of Andrews with the limitations of independent claim 1 to support its anticipation challenge over Andrews. Pet. 31–44. Because we find that mapping deficient with respect to the recited “thermally conductive region in solderable thermal contact with the thermally conducting base,” we focus the following discussion on that limitation. See Ex. 1001, 7:61–63.

As part of its mapping, Petitioner identifies Andrews’s thermal contact pad 36 (shown in purple in modified Andrews’s Figure 7B, reproduced above) as corresponding to the recited “thermally conductive region,” and identifies Andrews’s plate 51 and insulating film 49 (together shown in green in modified Andrews’s Figure 7B, reproduced above) as corresponding to the recited “thermally conducting base.” Pet. 43. Petitioner contends that this arrangement meets the limitation because

thermal contact pad 36 “can be fabricated using material having high heat conductivity such as gold, silver, tin, or other material including but not limited to precious metals,” and is therefore “solderable” to external heat sink 70. *Id.* at 42 (citing Ex. 1008 ¶¶ 55, 70; Ex. 1003 ¶ 162).

But this argument is not commensurate with the scope of the claim as we have construed it. In particular, in advancing this contention, Petitioner does not present any argument or evidence that thermal contact pad 36 of Andrews is in “solderable thermal contact” with the combination of plate 51 and insulating film 49. Rather, because we agree with Patent Owner that “‘solderable thermal contact’ requires solderability between the region and the base, **not** some other unclaimed structure,” we also agree with Patent Owner that “the Petition fails to show that Andrew[s] teaches a ‘thermally conducti[ve] region’ solderable to a ‘thermally conducting base.’” Prelim. Resp. 41.

In addition, Patent Owner specifically addresses the possibility that Andrews’s thermal contact pad 36 and insulating film 49 are in solderable contact, notwithstanding the omission of such an argument in the Petition. *See id.* at 41–42. Patent Owner observes that the bottom layer of what Petitioner identifies as the recited “thermally conducting base” is an electrically insulating film, and what Petitioner identifies as the recited “thermally conductive region” is an electrical conductor, “such as gold, silver, [or] tin.” *Id.* at 41 (quoting Ex. 1008 ¶ 70). As Patent Owner asserts, an attempt to solder a conductor such as gold, silver, or tin to a nonconductive insulating film “would fail to achieve the purpose of soldering—creating a connection to allow the flow of electricity between two objects—because, by definition, electric current cannot flow in an

electric insulator.” *Id.* at 41–42. That assertion is consistent with a technical dictionary’s definition of “solderability” as “[t]hat property of a *metal* surface to be readily wetted by molten solder.” *See* Ex. 3001 (definition by The Authoritative Dictionary of IEEE Standards Terms) (emphasis added).

In light of these considerations, we conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of independent claim 1 as anticipated by Andrews.

3. Dependent claims 2, 6, and 10

Each of challenged claims 2, 6, and 10 depends from claim 1. Ex. 1001, 8:1–3, 8:17–18, 8:28–29. As such, each of those claims includes the limitation of a “thermally conductive region in solderable thermal contact with the thermally conducting base.” 35 U.S.C. § 112 ¶ 4. Because we find Petitioner’s analysis is deficient with respect to this limitation, we also find Petitioner’s analysis deficient with respect to these dependent claims.

We conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of dependent claims 2, 6, and 10 as anticipated by Andrews.

E. Obviousness over Andrews

Petitioner challenges claims 1, 2, 6, and 10 as unpatentable under 35 U.S.C. § 103(a) over Andrews “[t]o the extent that the Board finds that Andrews does not anticipate claims 1, 2, 6, and 10 because [the anticipation ground] requires a combination of embodiments.” Pet. 47 (citing Pet. 32 n.6). Specifically, Petitioner contends that a person of skill in the art “would

have been motivated to add Andrews's top heat sink 40 and lens 50 to the substrate assembly depicted in Figure 7B in order to increase the device's optical performance and heat dissipation." *Id.* This contention does not address the limitation of a "thermally conductive region in solderable thermal contact with the thermally conducting base," for which we find Petitioner's anticipation analysis insufficient. We accordingly find Petitioner's obviousness analysis equally insufficient.

We conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of claims 1, 2, 6, and 10 as unpatentable under 35 U.S.C. § 103(a) over Andrews.

F. Anticipation by Bogner

Petitioner challenges claims 1, 2, 6, and 10 as anticipated by Bogner. Pet. 48–66.

1. Overview of Bogner

Bogner discloses an LED assembly optimized for high-temperature operation, as illustrated in Figure 2 of Bogner, a modified version of which is reproduced below with coloring added by Petitioner (and further modified by Petitioner's removal of the drawing label). Pet. 27.

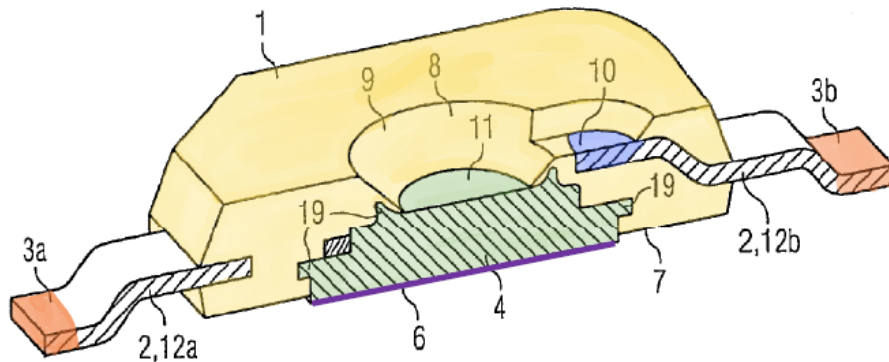


Figure 2 is a schematic perspective sectional view of a structure having base body 1 (yellow) made of a plastic molding compound that overlays thermal connecting part 4 (green), which is optimized “much better with regard to absorption and dissipation of greater levels of heat loss than an integral leadframe.” Ex. 1009, 2:26–29, 11:10–22. Thermal connection part 4 “is disposed inside the housing base body 1, so that the base surface 6 [(purple)] of the thermal connecting part 4 forms part of the base body contact surface 7.” *Id.* at 11:24–26. Bond wire connecting area 10 (blue) connects an LED die placed in chip-mounting area 11 with leadframe 2. *Id.* at 13:9–35.

2. Independent Claim 1

Petitioner provides a detailed mapping of disclosure of Bogner with the limitations of independent claim 1 to support its anticipation challenge over Bogner. Pet. 48–64. Because we find that mapping deficient with respect to the recited “thermally conductive region in solderable thermal contact with the thermally conducting base,” we focus the following discussion on that limitation. See Ex. 1001, 7:61–63.

As part of its mapping, Petitioner identifies Bogner’s base surface 6 (shown in purple in modified Bogner’s Figure 2, reproduced above) as corresponding to the recited “thermally conductive region,” and identifies Bogner’s thermal connecting part 4 (shown in green in modified Bogner’s Figure 2) as corresponding to the recited “thermally conducting base.” Pet. 60. Petitioner contends that this arrangement meets the limitation because a person of skill in the art “would have understood that base surface 6 . . . is of a piece with thermal connecting part 4, and that it is

solderable (*to a structure outside the assembly*) because Bogner discloses that thermal connecting part 4 may be formed of solderable metals such as copper.” *Id.* (citing Ex. 1009, 4:25–33; Ex. 1003 ¶ 228) (emphasis added).

But this argument is not commensurate with the scope of the claim as we have construed it. We agree with Patent Owner that “it is irrelevant to the ‘solderable thermal contact’ requirement whether the region is solderable to ***some other structure***; what matters is whether it can be soldered to the recited ***base***.” Prelim. Resp. 43. Furthermore, as Patent Owner points out, “Bogner makes explicit that ‘thermal connection part 4’ and ‘base surface 6’ are ***not*** two separate structures.” *Id.* Bogner consistently describes the bottom surface as “the base surface 6 *of the thermal connecting part 4*.” Ex. 1009, 11:25, 12:11 (emphasis added). Moreover, Petitioner appears to recognize the unitary nature of this structure in asserting that Bogner’s base surface 6 “is of a piece” with thermal connecting part 4. Pet. 60. In light of this unitary structure, we agree with Patent Owner that Bogner’s thermal connecting part 4 and its base surface 6 “cannot be ‘solderable’ to one another, *i.e.*, at no point in time could they be soldered to each other because they are simply one singular piece.” Prelim. Resp. 44

Accordingly, we conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of independent claim 1 as anticipated by Bogner.

3. *Dependent Claims 2, 6, and 10*

As noted above, because each of challenged claims 2, 6, and 10 depends from claim 1, they each include the limitation of a “thermally conductive region in solderable thermal contact with the thermally

conducting base.” Ex. 1001, 8:1–3, 8:17–18, 8:28–29; 35 U.S.C. § 112 ¶ 4. Because we find Petitioner’s analysis is deficient with respect to this limitation in addressing independent claim 1, we also find Petitioner’s analysis deficient with respect to these dependent claims.

We conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of dependent claims 2, 6, and 10 as anticipated by Bogner.

G. Obviousness over Bogner

Petitioner challenges claims 1, 2, 6, and 10 as unpatentable under 35 U.S.C. § 103(a) over Bogner “to the extent that the Board finds that Bogner’s ‘solder connecting strips’ are not ‘solderable bonding pad[s].’” Pet. 66. This aspect of Petitioner’s anticipation analysis is not relevant to Petitioner’s deficient showing for the limitation of a “thermally conductive region in solderable thermal contact with the thermally conducting base.” Petitioner’s alternative obviousness challenge thus suffers from the same defect as its anticipation challenge.

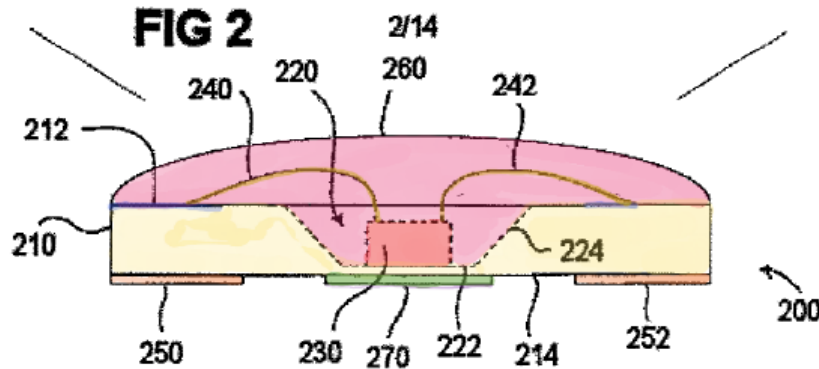
We conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of claims 1, 2, 6, and 10 as unpatentable under 35 U.S.C. § 103(a) over Bogner.

H. Anticipation by Yoganandan

Petitioner challenges claims 1, 2, 6, and 10 as anticipated by Yoganandan. Pet. 68–84.

1. Overview of Yoganandan

Yoganandan “relates to a high-power light source in the form of a light emitting diode (LED) package.” Ex. 1010 ¶ 1. A portion of Figure 2 of Yoganandan, modified with coloring added by Petitioner, is reproduced below. Pet. 29.



The portion of Figure 2 reproduced above is a front view of a surface-mount LED package (omitted portions show plan and side views of the same structure). Ex. 1010 ¶ 18. The LED package has rectangular planar substrate 210 (yellow), with LED die 230 (red) mounted within recess 220 of substrate 210. *Id.* ¶ 28–29. Substrate 210 overlays thermal dissipation pad 270 (green) located on lower surface 214 of substrate 210, with thermal dissipation pad 270 “provid[ing] an efficient heat path from the die to an external surface of the package.” *Id.* ¶ 31.

Conductive pads 250, 252 (orange) at the bottom of substrate 210 provide a surface for surface-mounting LED package 200 onto a printed circuit board. *Id.* ¶ 30. Thin gold wires 240, 242 (gold) are electrically coupled at one end to LED die 230 to supply electric current across a semiconductor junction of LED die 230. *Id.* ¶ 29. Transparent or translucent encapsulant material 260 (pink) is bonded to upper surface 212

of substrate 210 to encapsulate terminals on upper surface 212, gold wires 240, 242, and LED die 230. *Id.* ¶ 33.

2. Independent Claim 1

Petitioner provides a detailed mapping of disclosure of Yoganandan with the limitations of independent claim 1 to support its anticipation challenge. Pet. 68–80. Because we find that mapping deficient with respect to the recited “thermally conductive region in solderable thermal contact with the thermally conducting base,” we focus the following discussion on that limitation. *See* Ex. 1001, 7:61–63.

Similar to its anticipation analysis over Bogner, Petitioner identifies a unitary structure as corresponding both to the recited “thermally conducting base” and “thermally conductive region.” That is, Petitioner identifies the bottom surface of Yoganandan’s dissipation pad 270 as corresponding to the recited “thermally conductive region,” while identifying the pad itself as corresponding to the recited “thermally conducting base.” Pet. 78–79. In doing so, Petitioner quotes disclosure from Yoganandan that dissipation pad 270 “is made from metal, preferably copper plated with nickel,” and that “the exposed surface of the pad 270 is ideally located for soldering to a heat sink of a printed circuit board on which the package may be surface mounted.” *Id.* at 78 (quoting Ex. 1010 ¶ 32) (emphasis omitted).

Petitioner’s analysis is deficient for substantially the same reasons that its anticipation analysis over Bogner is deficient. First, Petitioner’s argument is not commensurate with the scope of the claim as we have construed it, because it is irrelevant to the “solderable thermal contact” requirement whether the “thermally conductive region” is solderable to some

external structure, such as the “heat sink of a printed circuit board” identified by Petitioner. Second, Petitioner identifies only a unitary structure as corresponding to both elements of the claim limitation, but the surface of dissipation pad 270 cannot be “solderable” to dissipation pad 270 itself.

Accordingly, we conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of independent claim 1 as anticipated by Yoganandan.

3. Dependent Claims 2, 6, and 10

Similar to the anticipation challenges of claims 2, 6, and 10 over Andrews and over Bogner, the incorporation of the limitation of a “thermally conductive region in solderable thermal contact with the thermally conducting base” into those claims by virtue of their dependence from independent claim 1 renders Petitioner’s analysis with respect to those dependent claims deficient. We conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of claims 2, 6, and 10 as anticipated by Yoganandan.

I. Summary

Because we conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on any of its challenges on the merits, we do not reach Patent Owner’s argument that the Petition should be denied under 35 U.S.C. § 314(a). See Prelim. Resp. 47–56.

III. ORDER

In consideration of the foregoing, it is
ORDERED that the Petition is *denied* and no trial is instituted.

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