

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS CO. LTD.,  
Petitioner,

v.

LED WAFER SOLUTIONS, LLC,  
Patent Owner.

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IPR2021-01554  
Patent 9,502,612 B2

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

ABRAHAM, *Administrative Patent Judge*.

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

## I. INTRODUCTION

### A. Background and Summary

Samsung Electronics Co. Ltd. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–9 of U.S. Patent No. 9,502,612 B2 (Ex. 1001, “the ’612 patent”). Paper 1 (“Pet.”). LED Wafer Solutions, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply to the Preliminary Response (Paper 7) and Patent Owner filed a Sur-reply (Paper 8).

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

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

### B. Related Proceedings

The parties identify *LED Wafer Solutions, LLC v. Samsung Electronics Co., Ltd.*, No. 6:21-cv-00292 (W.D. Tex.) and IPR2021-01504, which involve the ’612 patent, as related matters. Pet. 1; Paper 3, 1. Patent Owner further identifies the following related matters in which additional patents owned by Patent Owner are challenged: IPR2021-01479, IPR2021-

01491, IPR2021-01506, IPR2021-01516, and IPR2021-01526. Paper 3, 1–2.

### *C. The '612 Patent*

The '612 patent is titled “Light Emitting Diode Package With Enhanced Heat Conduction.” Ex. 1001, code (54). The '612 patent is directed to light emitting diode (LED) devices that contain certain layers that “act to promote mechanical, electrical, thermal, or optical characteristics of the device.” Ex. 1001, code (57). In particular, the '612 patent discloses LED devices that avoid or ameliorate heat dissipation problems found in conventional LED devices. Ex. 1001, code (57). The '612 patent explains that enhanced heat conduction is achieved using “augmented thermal capacity materials” and novel processing methods. Ex. 1001, 4:44–49.

One embodiment of the '612 patent aimed at improving thermal management of LEDs is shown below in Figure 5.

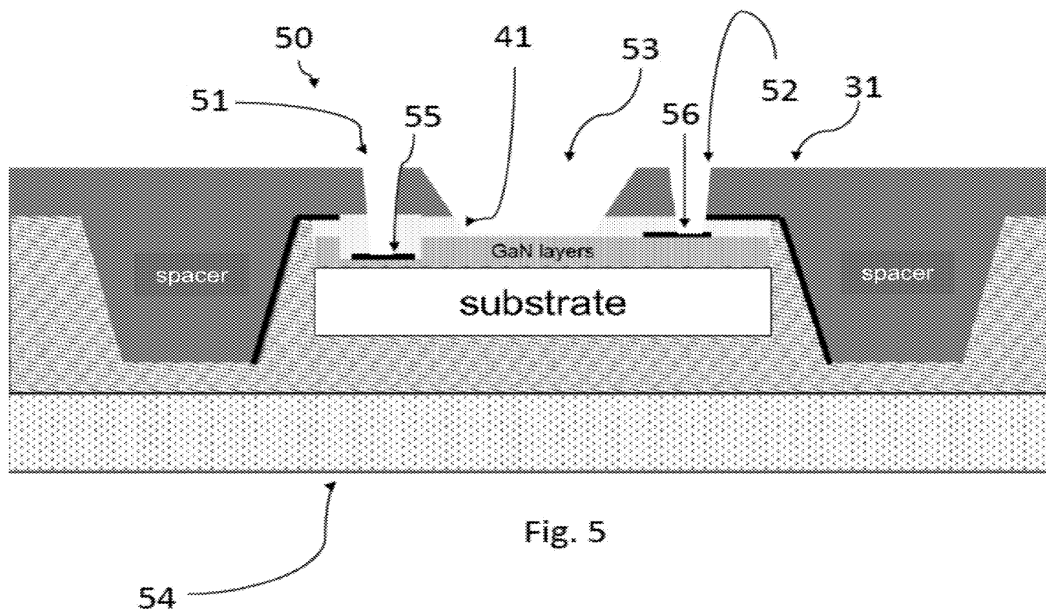


Figure 5 shows LED package 50 having cover substrate 54, an LED chip (labelled as GaN layers), silicon wafer 31, and adhesive material 41

disposed between the LED chip and silicon wafer 31. Ex. 1001, 8:60–66. Figure 5 also depicts various geometric reliefs etched in silicon wafer 31 in the form of vias 51 and 52, and thermally conducting hole 53. Ex. 1001, 9:4–18.

The '612 patent explains that adhesive material 41 can be thermally conductive, and can also have optical diffusion, transmission, and/or reflection properties. Ex. 1001, 4:4–14. Additionally, “[r]educing the thickness of the silicon enhances the thermal conductance of the LED package 50 and reduces the temperature of the LED during operation.” Ex. 1001, 8:63–66. According to the '612 patent, vias 51 and 52 and conducting hole 53 provide stress relief induced by grinding silicon wafer 31 down to a desired thickness to provide enhanced thermal conductance. Ex. 1001, 8:66–9:18. These features combine to provide improved LED packaging that allows for the efficient removal of excess heat during active LED operation. Ex. 1001, 4:44–52.

#### *D. Challenged Claims*

Petitioner challenges claims 1–9 of the '612 patent. Pet. 2–3. Claim 1 is the only independent claim challenged, and is reproduced below.

1. A light emitting device, comprising:
  - a substrate having opposing first and second substrate surfaces;
  - a semiconductor LED including doped and intrinsic regions thereof, said semiconductor LED having opposing first and second LED surfaces, said first LED surface disposed on the first substrate surface;
  - a thermally conductive layer disposed on the second LED surface of the semiconductor LED;
  - a carrier wafer disposed on the thermally conductive layer;

at least one optically reflective surface disposed between said carrier wafer and said semiconductor LED; and

a substantially optically transmissive layer disposed proximal to the second substrate surface,

wherein the carrier wafer and the thermally conductive layer define a relief to expose at least a portion of the second LED surface.

Ex. 1001, 12:14–31.

*E. The Asserted Grounds*

Petitioner asserts that claims 1–9 of the '612 patent are unpatentable based on the following challenges:

<b>Claim(s) Challenged</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>
1, 2, 8, 9	103(a) <sup>1</sup>	Tanaka <sup>2</sup>
3	103(a)	Tanaka, Weeks <sup>3</sup>
4–7	103(a)	Tanaka, Chitnis <sup>4</sup>
1, 2, 8, 9	103(a)	Tanaka, Applicant Admitted Prior Art (AAPA)
3	103(a)	Tanaka, AAPA, Weeks
4–7	103(a)	Tanaka, AAPA, Chitnis
1, 2, 8, 9	103(a)	Tanaka, Camras <sup>5</sup>
3	103(a)	Tanaka, Camras, Weeks
4–7	103(a)	Tanaka, Camras, Chitnis

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

<sup>2</sup> US 2003/0232455 A1, published Dec. 18, 2003 (Ex. 1005).

<sup>3</sup> US 7,233,028 B2, issued June 19, 2007 (Ex. 1006).

<sup>4</sup> US 2007/0284602 A1, published Dec. 13, 2007 (Ex. 1007).

<sup>5</sup> US 7,419,839 B2, issued Sept. 2, 2008 (Ex. 1008).

Pet. 10–11. Petitioner supports its showing of unpatentability of the challenged claims of the '612 patent with the Declaration of R. Jacob Baker, Ph.D. (Ex. 1002).

## II. ANALYSIS

### A. Claim Construction

Petitioner “believes no express constructions of any claim terms are necessary to assess whether the prior art reads on the challenged claims.” Pet. 9 (citing Ex. 1002 ¶ 35). Patent Owner “requests that the Board adopt the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art.” Prelim. Resp. 26–27.

We determine that no terms require express construction for purposes of determining whether to institute a trial. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

### B. Legal Standards

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

skill in the art; and (4) when presented, objective evidence of non-obviousness.<sup>6</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

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

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

### *C. Level of Ordinary Skill in the Art*

With regard to the level of ordinary skill in the art, Petitioner contends that a person of ordinary skill at the time of the invention of the ’612 Patent “would have had a bachelor’s degree in electrical engineering, material

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<sup>6</sup> The parties have not asserted or otherwise directed our attention to any objective evidence of nonobviousness.

science, or the equivalent, and two or more years of experience with light emitting diodes (LEDs).” Pet. 5 (citing Ex. 1002 ¶¶ 20–21). Patent Owner contends that a person of ordinary skill in the art “would have had a bachelor’s degree in electrical engineering or a similar field, and at least . . . two years of professional experience, or its equivalent, in the *manufacture of light sources* using light emitting diodes (“LEDs”).” Prelim. Resp. 5. Patent Owner states that its position and Petitioner’s position are “substantially similar.” Prelim. Resp. 5.

We agree with Patent Owner that the parties’ positions are substantially similar. However, for the purposes of this Decision, we determine that Petitioner’s slightly broader proposed level of ordinary skill in the art (which does not limit professional experience to the manufacturing of light sources) is consistent with the ’612 patent and asserted prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Therefore, we adopt Petitioner’s proposal for purposes of deciding whether to institute *inter partes* review.

#### *D. Consideration of Alleged Obviousness Based on Tanaka*

Our institution decision is based on consideration of Petitioner’s arguments and evidence regarding the teachings of Tanaka, either alone or in combination with the teachings of Weeks, Chitnis, AAPA, and/or Camras. *See* Pet. 2–3 (every asserted ground in the Petition relies on Tanaka either alone or in combination with Weeks, Chitnis, AAPA, and/or Camras). We start with a description of the disclosure of Tanaka, and then consider the arguments and evidence.

##### *1. Tanaka (Ex. 1005)*

Tanaka is titled “Semiconductor Light Emitting Element and Method of Making the Same,” and was published on December 18, 2003. Ex. 1005,



codes (43), (54). Tanaka aims to provide a less-expensive semiconductor light emitting element with improved processability and light-emitting efficiency. Ex. 1005 ¶¶ 10–12. Tanaka depicts one embodiment of its invention in Figure 7, which is reproduced below.

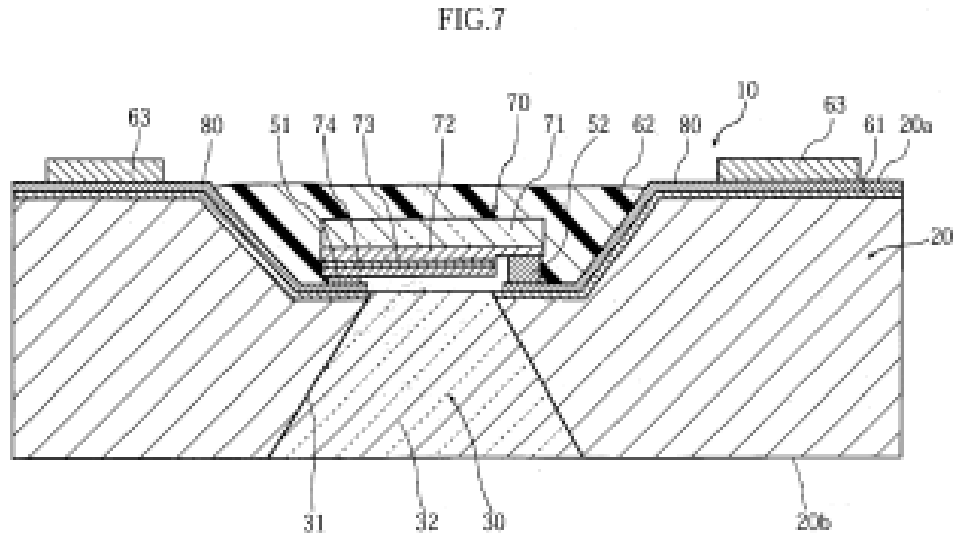


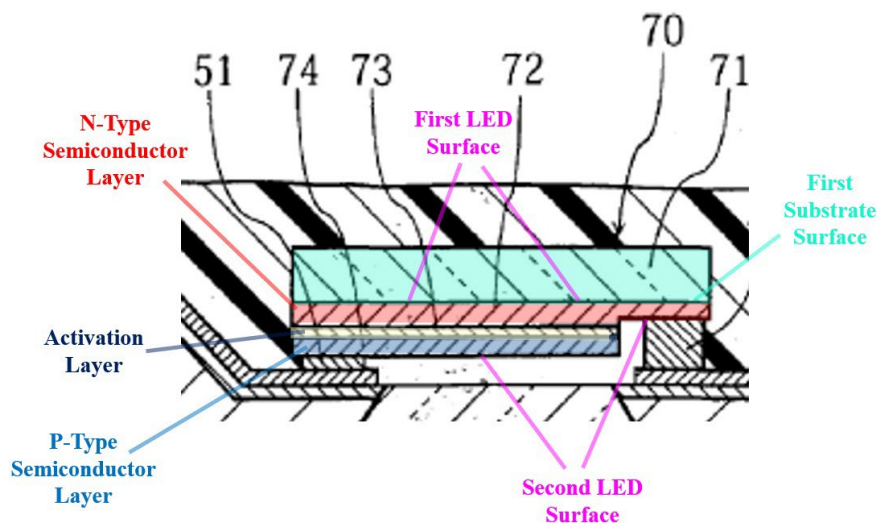
Figure 7 of Tanaka is a sectional view of semiconductor light-emitting element 10, with silicon substrate 20, blue-color light-emitting diode chip 70, P-side electrode 51, N-side electrode 52, wiring pattern 80, insulating layer 61, and protective member 62. Ex. 1005 ¶¶ 68–72. According to Tanaka, blue-color light-emitting diode chip 70 is comprised of sapphire substrate 71, N-type semiconductor layer 72, activation layer 73, and P-type semiconductor layer 74. Ex. 1005 ¶ 68. Additionally, hole 31 in silicon substrate 20 is preferably filled with translucent resin 32 to form light guide 30. Ex. 1005 ¶¶ 69–70. Tanaka explains that in the embodiment shown in Figure 7, “when the surface of the sapphire substrate 71 is formed with a metal reflector (not shown), light traveling from the activation layer 73 upward in the figure is reflected toward the light guide 30, which enhances

light-emitting efficiency of the semiconductor light-emitting element 10.”  
Ex. 1005 ¶ 72.

## 2. Analysis

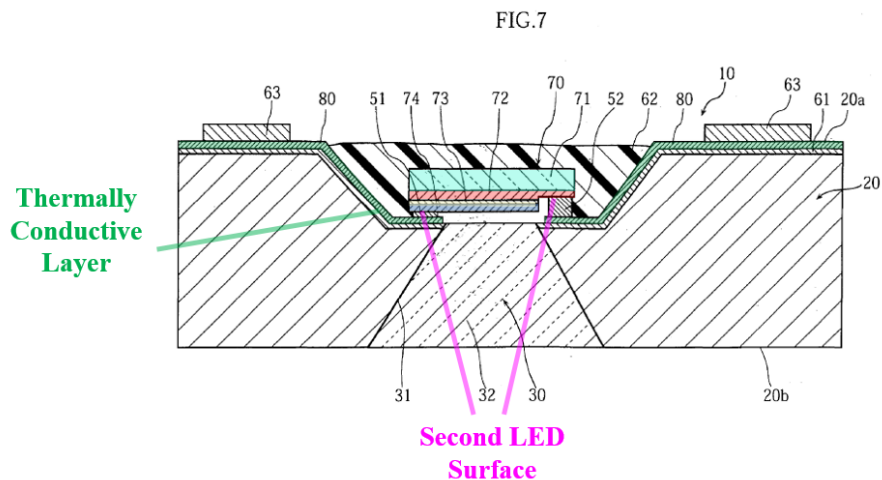
Independent claim 1 of the '612 patent recites, *inter alia*, “a semiconductor LED including doped and intrinsic regions thereof, said semiconductor LED having opposing first and second LED surfaces” and “a thermally conductive layer disposed on the second LED surface of the semiconductor LED.” Ex. 1001, 12:17–22.

Petitioner contends that Tanaka discloses or suggests a semiconductor LED including doped and intrinsic regions. Pet. 13. Specifically, Petitioner directs us to Tanaka’s description of light emitting element 10 as including “blue-color light-emitting diode chip 70 with an N-type semiconductor layer 72, a P-type semiconductor layer 74, and an activation layer 73 between the N- and P-type layers (collectively, the claimed ‘semiconductor LED’)” Pet. 13. Petitioner presents an annotated version of Tanaka Figure 7, reproduced below, to demonstrate that Tanaka’s “semiconductor LED” has opposing first and second LED surfaces. Pet. 14–15.



This annotated version of Figure 7 shows a sectional view of semiconductor light-emitting element 10 and focuses on blue-color light-emitting diode chip 70. Pet. 14–15. Petitioner annotates Figure 7 to identify the “First LED Surface” on one side of N-type semiconductor layer 72, and the “Second LED Surface” as the combination of the opposite side of N-type semiconductor layer 72 and one side of P-type semiconductor layer 74. Pet. 14–15.

Petitioner further contends that Tanaka’s wiring pattern 80 is a thermally conductive layer that is disposed on the second LED surface of Tanaka’s semiconductor LED, and thus argues that Tanaka discloses or suggests “a thermally conductive layer disposed on the second LED surface of the semiconductor LED,” as claim 1 requires. Pet. 16–17. Petitioner provides another annotated version of Figure 7, reproduced below, to support its argument. Pet. 17.



This annotated version of Figure 7 identifies wiring layer 80 as the claimed thermally conductive layer, highlights the layer in green, and shows its

spatial relationship with regard to the “Second LED Surface” of Tanaka’s semiconductor LED. Pet. 17.

Petitioner argues that a person of ordinary skill in the art would have understood that wiring pattern 80 is “disposed on” the second LED surface “at least because it overlaps with the second LED surface in the vertical direction of Tanaka’s Figure 7 embodiment (e.g., in the regions where the P-side electrode 51 and N-side electrode 5[2] are disposed).” Pet. 17–18 (citing Ex. 1005 ¶ 72, Fig. 7; Ex. 1002 ¶ 65). According to Petitioner,

This is consistent with the teachings of the ’612 patent, which describes an adhesive layer 41 (an example of the claimed thermally conductive layer) overlapping with the second LED surface of the GaN layers (an example of the claimed semiconductor LED) in the vertical direction of the Figure 5 embodiment (e.g., in the regions where the n-type pad 55 and p-type pad 56 are disposed). (Ex. 1002 ¶66.)

Pet. 18.

Patent Owner argues, *inter alia*, that Petitioner does not establish Tanaka discloses a thermally conductive layer disposed on the second LED surface. Prelim. Resp. 36. In particular, Patent Owner asserts that “Figure 7 of Tanaka shows the second LED surface of the semiconductor LED as being adjacent to a gap that exists between semiconductor layer 74 and light guide 30,” which is created because LED chip 70 is suspended above the level of wiring pattern 80 by electrodes 51 and 52. Prelim. Resp. 36. Based on this configuration, Patent Owner contends that “**there is nothing whatsoever disposed on the second LED surface.**” Prelim. Resp. 36.

We agree with Patent Owner that Petitioner has failed to demonstrate sufficiently that Tanaka discloses or suggests a thermally conductive layer disposed on the second LED surface of the semiconductor LED. Petitioner does not contend that Tanaka includes an express disclosure of metal wiring

80—which Petitioner identifies as the claimed thermally conductive layer—being “disposed on” the second LED surface of Tanaka’s semiconductor LED. Instead, Petitioner states only that a person of ordinary skill in the art would have understood that metal wiring 80 is disposed on the second LED surface because there are portions of metal wiring 80 that overlap the second LED surface in the vertical direction. Pet. 17–18. We find this statement to be conclusory and lacking adequate support.

In support of its assertion, Petitioner cites to paragraph 72 of Tanaka, which describes wiring pattern 80 being “directly connected” to electrodes 51 and 52. Ex. 1005 ¶ 72; Pet. 17. As noted above, Petitioner does not contend that electrodes 51 and 52 comprise the second LED surface. Instead, Petitioner maps the second LED surface in Tanaka to the lower surfaces of P-type semiconductor layer 74 and N-type semiconductor layer 72. Pet. 14–17. Petitioner, however, fails to explain sufficiently why paragraph 72 of Tanaka supports its conclusion that a person of ordinary skill in the art would have understood wiring layer 80 to be disposed on the lower surfaces of P-type semiconductor layer 74 and N-type semiconductor layer 72, surfaces not discussed in that paragraph. Petitioner also cites to paragraph 65 of Dr. Baker’s declaration in support of its assertion. Pet. 17–18. This paragraph, however, offers nothing beyond what appears in the Petition. *Compare* Ex. 1002 ¶ 65 *with* Pet. 17–18; *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.”).

The only other basis for Petitioner’s assertion regarding what a person of ordinary skill in the art would have understood about Tanaka’s disclosure is a comparison to “the teachings in the ’612 patent,” which purportedly describe adhesive layer 41 (a thermally conductive layer) overlapping the

second LED surface of the GaN layers in the vertical direction. Pet. 18 (referring to the embodiment shown in Figure 5 of the '612 patent). But other than the passing reference to Figure 5 of the '612 patent, Petitioner does not cite any portion of, or otherwise direct us to any discussion in, the '612 patent that expressly “describes an adhesive layer 41 . . . overlapping with the second LED surface of the GaN layers,” or explains that any such overlap constitutes one of the overlapping components being “disposed on” the other. Nor do we discern any such description or explanation in the '612 patent.

Furthermore, Petitioner’s assertion that the teachings of Tanaka are “consistent with the teachings of the '612 patent” is unavailing because Petitioner fails to address relevant differences between Tanaka’s Figure 7 embodiment and the embodiment shown in Figure 5 of the '612 patent. Pet. 18. Figure 5 of the '612 patent is reproduced below.

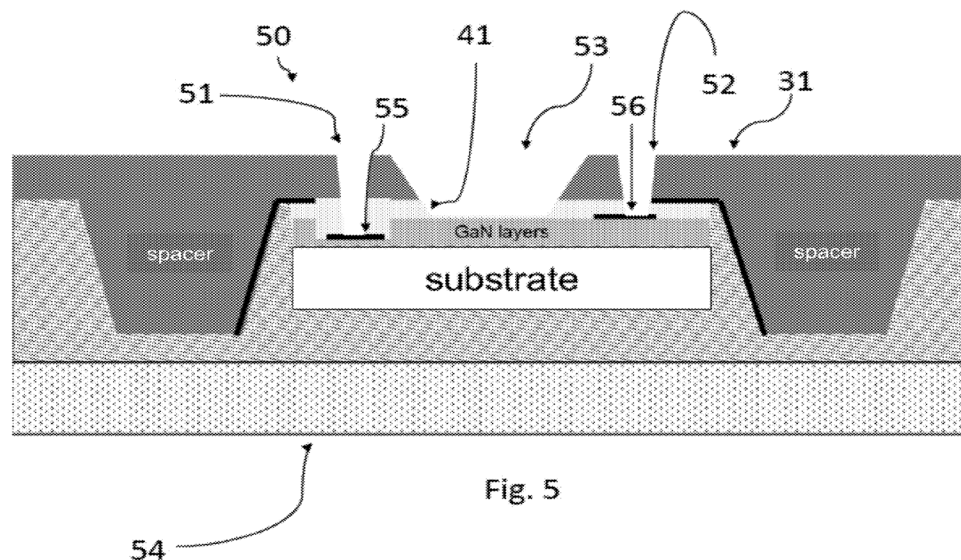


Figure 5 shows LED package 50 having an LED chip (labelled as GaN layers), silicon wafer 31, electrodes 55 and 56, and adhesive material 41 disposed between the LED chip and silicon wafer 31, and, in some places,

disposed between electrodes 55 and 56 and silicon wafer 31. Ex. 1001, 8:60–9:28. Notably, in Figure 5 of the '612 patent, adhesive material 41 (the thermally conductive layer) contacts the GaN layers (the semiconductor LED) in multiple places. In contrast, there is no contact between wiring pattern 80 and the second LED surface shown in Tanaka's Figure 7 embodiment. Instead, as Patent Owner points out, electrode pads 51 and 52 suspend LED chip 70 above the level of wiring pattern 80, thereby creating a gap. Prelim. Resp. 36.

Petitioner and Dr. Baker never address these differences between Tanaka and the '612 patent, or explain how they would (or would not) affect what a person of ordinary skill in the art would have understood from the teachings of Tanaka and the '612 patent. *See* Pet. 18; Ex. 1002 ¶ 66. Petitioner and Dr. Baker also never explain adequately why, despite these differences, they characterize Tanaka's disclosure as "consistent with the teachings of the '612 patent." Pet. 18; Ex. 1002 ¶ 66. In view of these deficiencies, we are not persuaded by Petitioner's conclusions regarding what a person of ordinary skill in the art would have understood based on the purported consistency between the teachings of Tanaka and the '612 patent.

For all of the foregoing reasons, we determine Petitioner has not provided evidence sufficient to support a conclusion that a person of ordinary skill in the art would have understood Tanaka discloses or suggests wiring pattern 80 is disposed on the second LED surface. For at least this reason, we determine Petitioner has not demonstrated sufficiently that Tanaka teaches or suggests "a thermally conductive layer disposed on the second LED surface of the semiconductor LED," as recited in claim 1.

Petitioner relies on Tanaka’s purported disclosure of this limitation for all of its unpatentability challenges. *See* Pet. 2–3, 63–64 (repeating that Tanaka discloses or suggest the features of claim 1 and stating that the “modification of Tanaka based on the AAPA does not affect the remainder of the analysis in Section IX.A”), 65–69 (repeating that Tanaka discloses or suggest the features of claim 1 and stating that the “modification of Tanaka based on Camras does not affect the remainder of the analysis in Section IX.A, which applies equally to this ground”). Petitioner does not direct us to any portions of Weeks, Chitnis, AAPA, or Camras that cure this deficiency. *See* Pet. 42–48 (relying on Weeks for its disclosure of a Distributed Bragg Reflector), 49–62 (relying on Chitnis for its disclosure of a conductive adhesive having the property of high thermal conductivity), 63–64 (relying on AAPA for its purported disclosure of an intrinsic region), 65–65 (relying on Camras for its purported disclosure of an intrinsic region). As a result, Petitioner has failed to establish a reasonable likelihood of showing claims 1–9 would have been unpatentable in view of the teachings of Tanaka, either alone or in combination with the teachings of Weeks, Chitnis, AAPA, and/or Camras.

### III. CONCLUSION

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

### IV. ORDER

In consideration of the foregoing, it is:

ORDERED that the Petition is *denied* and no *inter partes* review as to any claim of the ’612 patent is instituted.



IPR2021-01554  
Patent 9,502,612 B2

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