

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEOUL SEMICONDUCTOR CO., LTD., and
SEOUL SEMICONDUCTOR, INC.,
Petitioner,

v.

DOCUMENT SECURITY SYSTEMS, INC.,
Patent Owner.

IPR2020-00938
Patent 7,315,119 B2

Before SCOTT C. MOORE, AMBER L. HAGY, and JASON M. REPKO,
Administrative Patent Judges.

REPKO, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Seoul Semiconductor Co., Ltd. and Seoul Semiconductor, Inc. (collectively “Petitioner”) filed a petition to institute *inter partes* review of claims 1–7 of U.S. Patent No. 7,315,119 B2 (Ex. 1001, “the ’119 patent”). Paper 1 (“Pet.”). Document Security Systems, Inc. (“Patent Owner”) did not file a Preliminary Response.

On November 20, 2020, we instituted an *inter partes* review of all challenged claims based on all grounds in the Petition. Paper 6 (“Inst. Dec.”). Patent Owner filed a Response. Paper 17 (“PO Resp.”). Petitioner filed a Reply. Paper 25 (“Pet. Reply”). Patent Owner filed a Sur-reply. Paper 32 (“Sur-reply”). An oral hearing was held on August 27, 2021. A transcript of that hearing has been entered into the record. Paper 38 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued under 35 U.S.C. § 318(a). For the reasons that follow, Petitioner has shown by a preponderance of the evidence that claims 1–7 are unpatentable.

A. Related Matters

According to Petitioner, six cases in the Central District of California may be related: *Document Security Systems, Inc. v. Seoul Semiconductor Company, Ltd.*, No. 8:19-cv-01792 (C.D. Cal.); *Document Security Systems, Inc. v. Seoul Semiconductor Co. Ltd.*, No. 8:17-cv-00981 (C.D. Cal.); *Document Security Systems, Inc. v. Cree, Inc.*, No. 2:17-cv-04263 (C.D. Cal.); *Document Security Systems, Inc. v. Everlight Electronics Co., Ltd. et al.*, No. 2:17-cv-04273 (C.D. Cal.); *Document Security Systems, Inc. v. OSRAM GmbH*, No. 2:17-cv-05184 (C.D. Cal.); and *Document Security Systems, Inc. v. Lite-On, Inc.*, No. 2:17-cv-06050 (C.D. Cal.). Pet. 2.

Patent Owner identifies only one of those cases as related: *Document Security Systems, Inc. v. Seoul Semiconductor Company, Ltd.*, No. 8:19-cv-01792 (C.D. Cal.). Paper 4, 2 (Patent Owner’s Mandatory Notice); Paper 21, 2 (Patent Owner’s Updated Mandatory Notices).

B. The ’119 Patent

The ’119 patent generally relates to a white-emitting LED.¹ Ex. 1001, 1:12–15. These LEDs emit a combination of blue and yellow light in a particular ratio of intensities to cause the emitted light to be perceived as white. *Id.* at 1:16–19. In particular, devices can use an LED to emit blue light. *Id.* at 1:19–20. Phosphors covering the LED convert a part of that blue light into yellow light. *Id.* at 1:20–22. In one design, phosphor particles surround a high-intensity blue LED. *Id.* at 1:24–26. To obtain a white-emitting LED, the thickness and uniformity of the phosphor layer must be carefully controlled. *Id.* at 1:26–28. Without such controls, a non-uniform distribution of phosphor particles can form a boundary that can later split. *Id.* at 1:37–43. Other problems can cause an observer to perceive color variation across the light source. *Id.* at 1:44–62.

To address these issues, the ’119 patent describes a method of manufacturing a light source using a volatile carrier material and a slurry of phosphor particles. *Id.* at 2:18–33. The phosphor particles are uniformly distributed in the carrier material. *Id.* at 4:20–22. The layer is then baked to drive away some of the carrier. *Id.* at 4:22–26. This baking evaporates the volatile carrier and leaves a phosphor-particle residue on the light source. *Id.* According to the ’119 patent, “the phosphor particles all settle down and are

¹ Light-emitting diode. Ex. 1001, 1:14.

deposited around the LED chip and at least some portions of the cavity walls.” *Id.* at 4:24–26.

C. Claims

Claims 1 and 2, reproduced below, are independent.

1. A light emitting device comprising:

- a light source that generates light of a first wavelength, said light source comprising a die that emits light at said first wavelength;
- a conformal layer of phosphor particles covering said die and in direct contact therewith, said phosphor particles converting at least a portion of said light of said first wavelength to light of a second wavelength, said layer having a substantially uniform thickness of less than 100 μm over said die; and
- a reflecting cup comprising reflective sidewalls, said die being located in said cup such that a portion of said light generated by said die is reflected from said cup, said layer of phosphor particles covering a portion of said reflective sidewalls.

Ex. 1001, 5:26–6:3.

2. A light emitting device comprising:

- a light source that generates light of a first wavelength; and
- a layer of phosphor particles covering said light source, said phosphor particles converting at least a portion of said light of said first wavelength to light of a second wavelength, said layer comprising a residue of a slurry of said phosphor particles in a volatile solvent, said residue comprising the portion of said slurry that remains when a portion of said volatile solvent is removed.

Id. at 6:4–14.

D. Evidence

Name	Reference	Exhibit No.
Nichia-614	JP 2003-115614 A, published Apr. 18, 2003	1014
Nichia-341	US 2003/0080341 A1, published May 1, 2003	1015

Name	Reference	Exhibit No.
Matsushita	JP 2000-150966 A, published May 30, 2000	1016
Koike	US 6,345,903 B1, issued Feb. 12, 2002	1017

The declaration of William Alan Doolittle, Ph.D. (“Doolittle Decl.”) is Exhibit 1007. The declaration of R. Jacob Baker, Ph.D., P.E. (“Baker Decl.”) is Exhibit 2001.

E. Instituted Grounds

We instituted *inter partes* review of all challenged claims based on all grounds of unpatentability asserted in the Petition. Inst. Dec. 17; Pet. 2–3.

Claim(s) Challenged	Pre-AIA ² 35 U.S.C. §	Reference(s)/Basis
1–4, 7	102(b)	Nichia-614
5	103(a)	Nichia-614, Nichia-341
6	103(a)	Nichia-614, Nichia-341, Koike
1	103(a)	Matsushita, Nichia-614
1–7	102(b)/103(a)	Nichia-341

II. ANALYSIS

A. Principles of Law

In this decision, we must determine whether Petitioner has established by a preponderance of the evidence that the specified claims are unpatentable over the cited prior art. 35 U.S.C. § 316(e). 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). This burden never shifts to Patent Owner. *See Dynamic*

² Congress amended §§ 102 and 103, among other sections, when it passed the Leahy-Smith America Invents Act (AIA). Pub. L. No. 112–29, § 3(c), 125 Stat. 284, 287 (2011). Based on the ’119 patent’s filing date, the previous versions of §§ 102 and 103 apply.

Drinkware, LLC v. Nat'l Graphics, Inc., 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We instructed Patent Owner that “any arguments for patentability not raised in the [Patent Owner Response] may be deemed waived.” Paper 7, 8; *see also In re NuVasive, Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016) (holding that patent owner’s failure to make arguments at trial as instructed in the scheduling order constitutes waiver). Also, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Patent Trial and Appeal Board Consolidated Trial Practice Guide 66 (Nov. 20, 2019), *available at* <http://www.uspto.gov/TrialPracticeGuideConsolidated>.

B. Level of Ordinary Skill in the Art

According to Petitioner, “[a] person of ordinary skill in the art at the time of the purported invention would have had at least a B.S. in mechanical or electrical engineering or a related field, and two years’ experience designing LED packages.” Pet. 21. Petitioner asserts that “a higher level of education or skill might make up for less experience, and vice-versa.” *Id.*

Patent Owner disputes Petitioner’s assessment and proposes instead the level of skill offered in the Doolittle Declaration, submitted by Petitioner:

[T]he person of ordinary skill in the art at the relevant [time] would have had at least a Bachelor’s Degree in mechanical or electrical engineering and at least four years of experience with the LED field. A higher level of education, such as Master’s Degree, in electrical engineering, could substitute for work experience and additional work experience could substitute for a degree.

PO Resp. 9 (quoting Ex. 1007 ¶ 29) (emphasis omitted). Patent Owner does not, however, explain how this difference in experience level would affect our analysis. Indeed, we see nothing in the record that indicates that viewing the ordinarily skilled artisan as having two more years of experience would change the outcome here.

To the extent necessary, we apply Patent Owner’s adopted definition above because it is consistent with the ’119 patent and the asserted prior art and is supported by the Doolittle Declaration submitted by Petitioner. But our analysis would be the same under either definition.

C. Claim Construction

We need only construe terms that are in controversy and 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) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). In interpreting the claims here, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc).

1. Claim 1

a. “conformal” and “substantially uniform”

Claim 1 recites, in part, “a *conformal* layer of phosphor particles covering said die and in direct contact therewith, . . . said layer having a

substantially uniform thickness of less than 100 μm over said die.”

Ex. 1001, 5:30–35 (emphasis added).

Petitioner asserts that (1) the “conformal” modifier means that “the layer of phosphor particles conform to the shape of the underlying die,” and (2) “substantially uniform” means “largely or wholly the same in form.” Pet. 13–16.

Patent Owner does not dispute the meaning of “conformal” or “substantially uniform.” *See, e.g.*, PO Resp. 10–21. Instead, Patent Owner states that Dr. Baker applies Petitioner’s constructions. *Id.* at 10. Patent Owner, though, comments that Petitioner’s assertions about these terms are inconsistent with Petitioner’s argument that the “‘layer of phosphor’ particles should not be construed unless ‘patentee sets out a definition and acts as his own lexicographer’ or there is disavowal of claim scope.” Sur-reply 1.

We disagree that Petitioner’s positions are inconsistent. *See* Pet. 13–16. In particular, the patentee has not defined “conformal” or “substantially uniform” in the patent’s written description. *See id.* In fact, the terms do not appear in the Specification as originally filed. *Id.* at 13–14 (citing Ex. 1002, 152–162). And we see no other evidence of lexicography or disavowal with respect to these terms. *See* Ex. 1001. So, consistent with Petitioner’s articulation of the case law, the terms “conformal” and “substantially uniform” should be given “their ordinary and customary meaning as understood by a person of ordinary skill in the art when read in the context of the specification and prosecution history.” *See Thorner v. Sony Comp. Ent. Amer.*, 669 F.3d 1362, 1365 (Fed. Cir. 2012), *cited in* Pet. Reply 3.

As evidence of the “ordinary usage,” Petitioner cites the patent’s written description, the prosecution history, the Doolittle Declaration, and

technical dictionaries. *See* Pet. 13–16 (citing Ex. 1002, 102–108, 130, 152–162; Ex. 1004, 146; Ex. 1006, 242; Ex. 1007 ¶¶ 46, 47). This evidence provides ample support for Petitioner’s assertions about the ordinary and customary meaning of “conformal” and “substantially uniform.” *See id.*

Patent Owner does not present arguments specifically directed to these assertions. *See* PO Resp. 10–21; Sur-reply. Rather, Patent Owner states that its own declarant, Dr. Baker, analyzes the claims using Petitioner’s construction. PO Resp. 10.

In this decision, we adopt the constructions proposed by Petitioner. The evidence of record supports these constructions. And Patent Owner does not oppose them. Thus, in our analysis here, “conformal” means “conform to the shape of,” such that a “conformal layer of phosphor particles” means “the layer of phosphor particles conform to the shape of the underlying die,” and “substantially uniform” means “largely or wholly the same in form,” which is consistent with how the parties use the terms. *See* Pet. 13–16; PO Resp. 10.

Although the meaning of “conformal” and “substantially uniform” are not in dispute, Patent Owner does present arguments about which parts of the device must be “substantially uniform.” *See, e.g.,* PO Resp. 13–14. We address those arguments in the sections that follow.

b. “layer of phosphor particles”

Claim 1 recites, in part, “a conformal *layer of phosphor particles* covering said die and in direct contact therewith.” Ex. 1001, 5:30–31 (emphasis added).

The Petition does not provide an explicit construction for “layer of phosphor particles.” *See, e.g.,* Pet. 13–20. Petitioner, though, explains that “the plain language simply requires a layer *that includes* phosphor particles.”

Pet. Reply 10 (emphasis added). We agree. The claim uses the transitional term “comprising,” which indicates that the claim does not preclude other unrecited material from existing in the layer. *See, e.g., Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997) (“‘Comprising’ is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim.”). This means that the recited phosphor layer need not consist of *only* phosphor particles.

Also, the ’119 patent discloses that phosphor particles are distributed in a “carrier material” that is “partially” driven away to leave a layer of phosphor. Ex. 1001, 4:20–23. “[T]he residue of the carrier material *preferably* also acts as an adhesive to bind the phosphor particles to one another and to the LED and surrounding surface.” *Id.* at 4:45–47 (emphasis added). That is, the layer contains a carrier-material residue that binds the phosphor. *See id.*

This reading of the patent’s written description is consistent with Dr. Baker’s testimony. *See* Ex. 1032. For example, Dr. Baker explained,

as we discussed in the ’119, you simply – you can’t have a coating of phosphor. There has to be some adhesive or residue or something, as taught in the ’119, to adhere the phosphors together, for example.

Id. at 127:16–20, *quoted in* Pet. Reply 12. Dr. Baker’s explanation supports Petitioner’s argument that the recited phosphor layer must have something—an adhesive or residue, for example—in addition to the phosphor particles. Pet. Reply 12.

For these reasons, we agree with Petitioner that the recited “layer of phosphor particles” simply requires a layer that includes phosphor particles. *Id.* at 10.

Patent Owner does not directly dispute that a “layer of phosphor particles” is a layer that includes phosphor particles as well as other material. PO Resp. 10–11. But Patent Owner argues for additional constraints on the thickness of the phosphor layer and position of the particles within that layer. *Id.* In particular, Patent Owner argues that the recited “layer of phosphor particles,” as used in the ’119 patent, requires (1) “a phosphor layer at least two particles thick” in which (2) the bottom phosphor particles are in contact with the LED. *Id.* at 13. According to Patent Owner, these constraints are consistent with the understanding of a person of ordinary skill in the art. *Id.* We disagree for the reasons discussed in the sections that follow.

(1) *Patent Owner’s argument that the phosphor layer must be at least two particles thick*

Patent Owner argues that the inventors “clearly defined their layer of phosphor to have a thickness of more than one particle.” PO Resp. 13. In support of this position, Patent Owner cites the patent’s written description: “it is to be understood that the phosphor layers are actually uniform layers constructed from smaller particles, and *the layers are many particles thick.*” *Id.* (quoting Ex. 1001, 5:14–19). In Patent Owner’s view, this sentence defines the term “layer of phosphor particles.” *Id.*

To be sure, a patent “specification may reveal a special definition given to a claim term.” *Phillips*, 415 F.3d at 1316. Or it may reveal “an intentional disclaimer, or disavowal, of claim scope.” *Id.* “The patentee’s lexicography must, of course, appear ‘with reasonable clarity, deliberateness, and precision’ before it can affect the claim.” *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The patentee can disavow claim scope with language in the specification or the

prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016). “In either case, the standard for disavowal is exacting, requiring clear and unequivocal evidence that the claimed invention includes or does not include a particular feature.” *Id.*

For the phrase “layer of phosphor particles” recited in the claims here, we see no reasonably clear, deliberate, and precise lexicography in the ’119 patent’s written description. When read in context, the sentence that Patent Owner characterizes as definitional simply explains that the drawings are not to scale:

To simplify the drawings and better explain the present invention, the above figures show layers of relatively large phosphor particles that are only a few particles thick. However, it is to be understood that the phosphor layers are actually uniform layers constructed from much smaller particles, and the layers are many particles thick.

Ex. 1001, 5:14–19. Also, the drawings are not intended to be limiting:

Various modifications to the present invention will become apparent to those skilled in the art from the foregoing description and accompanying drawings. Accordingly, the present invention is to be limited solely by the scope of the following claims.

Id. at 5:20–24. Thus, the phrase “the layers are many particles thick” is not definitional because it merely refers to the layers in a non-limiting embodiment shown in the drawings.

Nor does anything in the rest of the patent’s written description impose a specific thickness on the recited layer. Rather, the written description explains that the invention “confines the phosphor particles to a *thin* layer over the LED chip.” *Id.* at 3:14–15 (emphasis added). Compared to the prior art, the invention purportedly uses a “much thinner phosphor

layer.” *Id.* at 3:59–60. But it does not state, for example, that a single layer of particles is too thin. *See id.*

Because Dr. Baker’s testimony on this issue is inconsistent with the patent’s written description, we assign it little weight. *See, e.g.,* Baker Decl. ¶ 51.

Thus, we do not adopt Patent Owner’s proposed requirement that the recited “layer of phosphor particles” must be “at least two particles thick.” *See* PO Resp. 13; Sur-reply 6.

(2) *Patent Owner’s argument that the bottom phosphor particles must be in contact with the LED*

Although the claim recites that the layer of phosphor is “in direct contact” with the die, we find that the recited “layer of phosphor particles” simply requires a layer that includes phosphor particles without further limitation on the position of the particles within the layer. In particular, we disagree with Patent Owner’s argument that the claims require that the layer’s bottom phosphor particles directly contact the LED. PO Resp. 11–13.

According to Patent Owner, the patent repeatedly emphasizes this feature. *See id.* To support this assertion, Patent Owner cites five sentences from the written description. *Id.* (citing Ex. 1001, 3:27–29, 3:40–41, 3:42–43, 3:56–57, 4:23–26). We disagree that, in those five sentences and elsewhere, the patentee defines “layer of phosphor particles” to limit the position of the bottom particles. None of the sentences cited by Patent Owner mentions direct contact between bottom phosphor particles and the LED. *See id.* Instead, most merely state that the phosphor layer *covers* the LED. Ex. 1001, 3:27–29 (“A *layer of phosphor 435* covers the LED and at least part of the walls of cavity 410.”), 3:40–41 (“A *layer of phosphor 535* covers the LED and partially covers the walls of said cavity.”), 3:42–43

(“the LED *covered* with said phosphor”), 3:56–57 (“A *layer of phosphor 630 covers* the LED and a portion of the substrate.”) (emphases added).

Patent Owner also quotes the sentence that reads in full: “In the proposed invention, a wavelength converting material such as phosphor is laid over the LED chip in a manner such that *substantially all* the phosphor particles are in contact with the LED chip and the walls of the cavity where the LED is mounted.” Ex. 1001, 3:16–19, *quoted in* PO Resp. 11 (emphasis added). The written description also discloses that “the phosphor particles all settle down and are deposited around the LED chip and at least some portions of the cavity walls.” *Id.* at 4:24–26, *quoted in* PO Resp. 12. Yet these sentences do not define the term “layer of phosphor” with the reasonable clarity, deliberateness, and precision required to limit the claim as Patent Owner proposes. In fact, the cited passages do not even explicitly use the term “layer of phosphor.” *Id.* Instead, these sentences describe a single, exemplary embodiment, which is not definitional. *See id.*

Lastly, Patent Owner points to the drawings to support its position. PO Resp. 12 (citing Ex. 1001, Figs. 2–4, 6). But the drawings are merely exemplary, non-limiting embodiments. *See* Ex. 1001, 5:20–24; *supra* § II.C.1.b(1).

In sum, we see no reason to interpret the claimed “layer of phosphor particles” as limited to the phosphor particles themselves. And we see no requirement in the claims that a “conformal layer of phosphor particles covering said die and in direct contact therewith” requires that the bottom layer of phosphor particles directly contact the LED, as Patent Owner has proposed. PO Resp. 11–13. Rather, consistent with the patent’s written description and the evidence of record, we determine that the recited “layer of phosphor particles” simply requires a layer that includes phosphor

particles, without limitation to the position of the bottom phosphor particles relative to the LED.

c. “covering a portion of . . . sidewalls”

Claim 1 further recites, in part, “said layer of phosphor particles covering a portion of said reflective sidewalls.” Ex. 1001, 6:2–3.

Patent Owner argues that “covering a portion of said side walls” should be construed as “covering a portion of said side walls above where the layer of phosphor particles covering the bottom surface intersects with the sidewalls.” PO Resp. 13 (citing Baker Decl. ¶ 52). Patent Owner argues that the antecedent basis for “said layer of phosphor particles covering a portion of said reflective sidewalls” is “said layer having a substantially uniform thickness of less than 100 μm .” *Id.* at 13–14 (quoting claim 1). In Patent Owner’s view, the antecedent basis requires that the side-wall layer also have a substantially uniform thickness. *Id.* at 14.

Yet the purported antecedent basis recites—in full—“said layer having a substantially uniform thickness of less than 100 μm *over said die*.” Ex. 1001, 5:33–35 (emphasis added). That is, claim 1 only requires uniform thickness for the layer that is “over said die” and is silent with respect to the thickness of the layer covering the side walls. Patent Owner’s antecedent-basis argument ignores the language “over said die.” *See* PO Resp. 13–14. Thus, “said layer having a substantially uniform thickness of less than 100 μm ” is not the antecedent basis for “said layer of phosphor particles covering a portion of said reflective sidewalls.”

Because Dr. Baker’s testimony on this issue contradicts the claim language in this regard, we assign it little weight. *See* Baker Decl. ¶¶ 52–58.

Patent Owner also argues that the drawings support its construction. PO Resp. 15–16 (Ex. 1001, Figs. 2–4, 6); *see also* Sur-reply 6 (measuring

the layer shown in a drawing). But the drawings are merely exemplary. *See* Ex. 1001, 5:20–24. Also, the patent explicitly states that the particles shown are not drawn to scale and may not reflect the actual number of particles. *See id.* at 5:14–19. So the drawings reveal little about the claimed layer’s thickness, uniformity, or coverage.

Patent Owner further argues that “requiring the phosphor layer extend up the sidewalls beyond the intersection point is in keeping with the purpose of the phosphor layer as taught by the specification.” PO Resp. 16 (citing Baker Decl. ¶ 57). Patent Owner asserts that the phosphor particles convert blue light to white light. *Id.* According to Patent Owner, the phosphor on the sidewalls maximizes this conversion:

Having a phosphor layer along the reflective sidewalls would help assure the maximum conversion of blue light to white light by exposing light rays to phosphor that might not have been converted to white light when leaving the LED during the process of being reflected off of the sidewalls.

Id. at 16–17.

“Though understanding the claim language may be aided by explanations contained in the written description, it is important not to import into a claim limitations that are not part of the claim. For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.” *Superguide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). Here, the claim only requires that the particles cover “a portion” of the sidewalls. The claim does not recite the portion’s size. Nor does the written description require a particular amount of coverage. *See, e.g.*, Ex. 1001, 5:14–19 (explaining that the drawings are exemplary and not to scale). Thus, we construe “covering a portion of . . . sidewalls” within the

full scope of its plain and ordinary meaning, which does not limit the portion's size or the extent of coverage in the way that Patent Owner proposes.

We need not further construe claim 1 to resolve the disputes here. *See Nidec*, 868 F.3d at 1017.

2. Claim 2

As for claim 2, Petitioner argues that the phrase “said layer comprising a residue of a slurry of said phosphor particles in a volatile solvent, said residue comprising the portion of said slurry that remains when a portion of said volatile solvent is removed” is a non-limiting product-by-process limitation. Pet. 16–18. Specifically, a product made by a process recited in a product-by-process claim may be anticipated by or obvious over prior-art products, even if those prior-art products are made by different processes. *Amgen Inc. v. F. Hoffmann-La Roche Ltd.*, 580 F.3d 1340, 1370 n.14 (Fed. Cir. 2009). In Petitioner's view, claim 2 only requires “a layer of phosphor particles covering said light source.” Pet. 17. According to Petitioner, “the recited slurry is not a structure within the recited ‘light emitting device,’ but instead is a material from which the layer of phosphor materials was created.” *Id.* at 16.

Petitioner also provides an alternative, narrower construction. *Id.* at 18. In particular, the process in which a product is formed may be given patentable weight “if that process imparts distinctive structural characteristics.” *Greenliant Sys., Inc. v. Xicor LLC*, 692 F.3d 1261, 1268 (Fed. Cir. 2012). According to Petitioner's alternative construction, the only disclosed physical properties that could be linked to the recited steps “are the ‘conformal’ and ‘substantially uniform thickness’ aspects of the disclosed structure.” Pet. 18. So Petitioner alternatively interprets the claim “to require

a conformal layer that is substantially uniform in thickness.” *Id.* at 37. Patent Owner agrees with this alternative construction. PO Resp. 18.

Our decision here would be the same under either construction of claim 2. *See infra* § II.D.3.b. So we need not determine whether Petitioner’s broader construction is correct. Instead, we apply the narrower construction that the phosphor layer must also be “conformal” and have “substantially uniform thickness.” As we note above, the modifier “conformal” means that “the layer of phosphor particles conform to the shape of the underlying die,” and “substantially uniform” means “largely or wholly the same in form.” *Supra* § II.C.1.a. Also, “substantially uniform thickness,” as the patent uses the term, refers to the thickness over said die. *Supra* § II.C.1.a.

Patent Owner argues that claim 2, like claim 1, requires a phosphor layer of a specific thickness with the bottom phosphor particles contacting the LED:

Here, the residue was not just any “layer of phosphor particles covering the light source” as Petitioner maintains, but a specific kind of phosphor layer having the characteristics taught by the ’119 Patent. The phosphor layer for claim 2 and its dependents is “at least two particles thick, the bottom particles of which are in contact with the LED” as required by the correct construction of the phrase described above.

PO Resp. 18. For the same reasons discussed with respect to claim 1, we disagree with Patent Owner’s proposed construction. *See supra* § II.C.1.

We need not further construe claim 2 to resolve the disputes here. *See Nidec*, 868 F.3d at 1017.

D. Anticipation by Nichia-614

Petitioner asserts that Nichia-614 anticipates claims 1–4 and 7. Pet. 30–40.

1. Nichia-614

Nichia-614 discloses a method for manufacturing a light-emitting element's phosphor layer. *See* Ex. 1014 ¶¶ 6, 15. Nichia-614 recognizes that applying an even amount of phosphor improves color-tone uniformity. *Id.* ¶ 15. In particular, Nichia-614's method sprays a coating liquid containing a phosphor in a spiral pattern. *Id.* ¶ 6. This spray coating uniformly disperses the phosphor over the light element's entire surface. *Id.* ¶ 33.

2. Claim 1

a. The Light Source

Claim 1 recites, in part, “a light source that generates light of a first wavelength, said light source comprising a die that emits light at said first wavelength.” Ex. 1001, 5:27–29.

Petitioner asserts that Nichia-614's light-emitting die 103 corresponds to the recited light source. Pet. 30–31. In the cited paragraphs, Nichia-614 discloses that a nitride-compound semiconductor emits “a relatively short wavelength” (Ex. 1014 ¶ 43) and that the light-emitting element produces blue light (*id.* ¶ 75).

We find that Petitioner has shown that Nichia-614 discloses the recited light source. Pet. 30–31.

b. “a conformal layer of phosphor particles covering said die and in direct contact therewith”

(1) “layer of phosphor particles”

According to the plain and ordinary meaning, the recited “layer of phosphor particles” simply requires a layer that includes phosphor particles. *Supra* § **Error! Reference source not found.** Petitioner asserts that Nichia-

614's layers 111 and 112 fall within the scope of the recited "layer of phosphor particles." Pet. 31–33. We agree. Our reasoning follows.

Patent Owner acknowledges that layer 111 contains phosphor. PO Resp. 19. Patent Owner, though, argues that Nichia-614's layer 111 is a "coating layer," not a "phosphor layer." *Id.* (citing Ex. 1014 ¶ 17).³ Patent Owner argues that, in Nichia-614's layer, phosphor is not the "main material." *Id.* (quoting Ex. 1014 ¶ 20); *see also* Sur-reply 11–14 (arguing that other materials are mixed with the phosphor to form the layer).

According to Patent Owner, Nichia-614 specifically teaches that the coating layer's main material is SiO₂, Al₂O₃, or MSiO₃, not phosphor. PO Resp. 19–20 (quoting Ex. 1014 ¶ 19); *see also* Sur-reply 9–10 (citing Ex. 1014 ¶¶ 19, 21, 72, 75). In Patent Owner's view, Nichia-614 teaches the type of device that the '119 patent purportedly improves. Sur-reply 9.

We disagree with Patent Owner's characterization of Nichia-614's "main material." PO Resp. 19–20; Sur-reply 9–14. Patent Owner attributes its own meaning to the phrase "main material" that is divorced from Nichia-614's disclosure. *See* PO. Resp. 19; Sur-reply 7–10. A review of Nichia-614, however, shows that the coating layer is similar to the phosphor layer disclosed in the '119 patent because both layers use another material to bind the phosphor.

To form the coating layer, Nichia-614 prepares "a mixed solution of an ethyl silicate hydrolyzed solution, ethylene glycol and a phosphor in a

³ Patent Owner's citations to Nichia-614 refer to the paragraph number that appears after the text. *See, e.g.*, PO Resp. 19. Because the last paragraph of Nichia-614 lacks a number and the first paragraph is preceded by a number, we refer to the paragraph number that precedes the text here and elsewhere when we refer to Patent Owner's citations.

weight ratio of 1:1:1.” Ex. 1014 ¶ 66, *quoted in* Pet. 37. Nichia-614 then explains that the coating mixture is “dried at a temperature of 300°C for 2 hours, whereby ethanol generated during hydrolysis of ethyl silicate, and a solvent are *completely evaporated*.” *Id.* ¶ 73 (emphasis added), *quoted in* Pet. 37. According to Nichia-614, SiO₂ and Al₂O₃ are “specific examples of the main material of the coating layer.” *Id.* ¶ 20. In the coating layer, SiO₂ or Al₂O₃ adheres the phosphor particles. *Id.* ¶ 19. In other words, the phosphor in the coating layer is bound by the “main material.” *Id.*

Similarly, the layer disclosed in the ’119 patent has a “carrier material” for binding the phosphor. *Compare* Ex. 1001, 4:45–47, *with* Ex. 1014 ¶¶ 19–20. As discussed in the *Claim Construction* Section, the recited phosphor layer does not exclude other materials. *Supra* § II.C.1.b. For example, Dr. Baker testified that a phosphor coating needs something to adhere the phosphor particles together. Ex. 1032, 127:16–20. And Patent Owner acknowledges that “the phosphor layer can have a residue of carrier material to assist in binding.” Sur-reply 8 (emphasis omitted). Likewise, the ’119 patent discloses that “the residue of the carrier material *preferably* also acts as an adhesive to bind the phosphor particles to one another and to the LED and surrounding surface.” Ex. 1001, 4:45-47 (emphasis added).

In sum, because it contains a material in addition to phosphor, Nichia-614’s layer of phosphor particles is like the layer described in the ’119 patent’s written description. *See* Ex. 1014 ¶¶ 19–20, 66, 73. For this reason, we disagree with Patent Owner’s attempt to distinguish the recited layer of phosphor particles from Nichia-614’s layer on the basis of its “main material.” PO Resp. 19–20; Sur-reply 7–14. Rather, the full scope of the plain and ordinary meaning of “layer of phosphor particles” simply requires a layer that includes phosphor particles. *Supra* § **Error! Reference source**

not found.. And it is undisputed that Nichia-614’s layers 111 and 112 include phosphor particles. Pet. 31–33; PO Resp. 19. Thus, Nichia-614’s layers fall within the scope of the recited “layer of phosphor” under the plain and ordinary meaning of the term. *Supra* § II.C.1.b.

Patent Owner’s incorrect claim constructions are the basis for other arguments about Nichia-614. PO Resp. 20–21; Sur-reply 12; *see supra* § II.C (addressing Patent Owner’s claim construction).

In particular, Patent Owner argues that Nichia-614 does not disclose the phosphor layer because the phosphor within Nichia-614’s layer is not “in direct contact” with the die. PO Resp. 20–21. We disagree because (1) Nichia-614’s entire coating layer 111 is a layer that includes phosphor particles, as required by the claim (*supra* § II.C.1.b), and (2) Patent Owner acknowledges that Nichia-614’s “coating layer is in contact with the LED” (PO Resp. 20). Thus, Petitioner has shown that Nichia-614’s layer of phosphor particles covers the die and is in direct contact with it. Pet. 31–33.

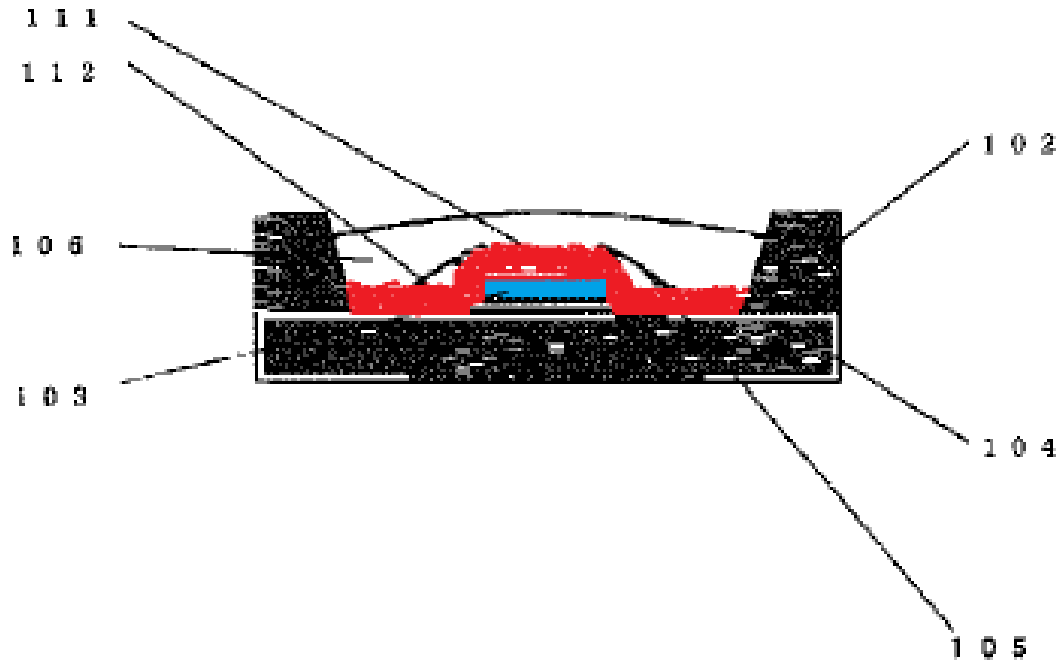
Patent Owner also argues that Nichia-614’s layer is not a layer of phosphor because it is less than two-particles thick. PO Resp. 21; Sur-reply 12. We disagree. For the reasons discussed in the *Claim Construction* Section, we determine that the claim does not impose such a thickness requirement. *See supra* § II.C.1.b(1). Because Dr. Baker’s testimony is based on Patent Owner’s construction, we accord it little weight on this issue. *See Baker Decl.* ¶ 64.

We find Petitioner has shown that that Nichia-614 discloses the recited “layer of phosphor particles.” Pet. 31–33.

(2) “conformal layer of phosphor particles”

Here, “conformal” means “conform to the shape of,” such that “the layer of phosphor particles conform to the shape of the underlying die.”

Supra § II.C.1.a. Petitioner asserts that the recited conformal layer of phosphor particles encompasses Nichia-614's layers of phosphor particles (111 and 112). Pet. 31–33. Nichia-614's Figure 2, shown below with annotations, shows layers 111 and 112. *Id.* at 32.



Nichia-614's Figure 2, shown above with Petitioner's annotations, is a schematic cross-sectional diagram of an LED chip (103) mounted on a package (102). *Id.*

The figure above shows the phosphor layer in red. *Id.* In particular, coating layer 111 is shown on top of LED chip 103 and coating layer 112 is on top of the support. *Id.* As a result, layers 111 and 112 follow the shape of the underlying structure. *Id.* In this way, phosphor layers 111 and 112 conform “to the shape of the underlying die,” as required by the term “conformal.” *Id.* at 31–33.

We find that Petitioner has shown that Nichia-614 discloses “a conformal layer of phosphor particles covering said die and in direct contact therewith.” *Id.* at 12–13; 31–33.

- c. “*said phosphor particles converting at least a portion of said light of said first wavelength to light of a second wavelength*”

As for the recited converting, the paragraph of Nichia-614 cited in the Petition explains that layers 111 and 112 convert light emitted by LED chip 103. Ex. 1014 ¶ 17, *cited in* Pet. 32.

Apart from the arguments discussed in the *Claim Construction* Section (*supra* § II.C), Patent Owner does not substantively address Petitioner’s arguments and evidence about this limitation. *See* PO Resp.; Sur-reply.

We find that Petitioner has shown that Nichia-614 discloses “said phosphor particles converting at least a portion of said light of said first wavelength to light of a second wavelength.” Pet. 32.

- d. “*said layer having a substantially uniform thickness of less than 100 μm over said die*”

Petitioner asserts that Nichia-614’s layers have “a substantially uniform thickness of less than 100 μm over said die.” *Id.* at 32–33 (citing Ex. 1014 ¶¶ 17, 33, 60–62, 74). Specifically, Nichia-614 discloses that the phosphor layer is about 20 μm thick: “By the steps described above, a phosphor is contained *uniformly* in the coating layer and the coating layer having layer *thickness of about 20 μm* is formed on the upper surface, side surfaces, and corner parts of the light emitting device.” Ex. 1014 ¶ 74 (emphasis added). Thus, Petitioner has shown that Nichia-614’s layer has the claimed thickness. *See* Pet. 33.

In the context of the ’119 patent, “substantially uniform” means “largely or wholly the same in form.” *Supra* § II.C.1.a. According to Petitioner, “Because the thickness of the phosphor-containing layer on the chip is described as ‘substantially equal’ and ‘formed at the same film

thickness,’ Nichia-614 discloses that the layer is largely or wholly the same in form.” Pet. 33 (citing Doolittle Decl. ¶ 60). We agree with Petitioner’s contentions, which are supported by the cited disclosures. Indeed, the cited part of Nichia-614 states that “a phosphor is uniformly dispersed on the entire surface” by the spray coating. Ex. 1014 ¶ 33, *cited in* Pet. 32.

Apart from the arguments discussed in the *Claim Construction* Section (*supra* § II.C), Patent Owner does not substantively address Petitioner’s arguments and evidence about this limitation. *See* PO Resp.; Sur-reply.

We find that Petitioner has shown that Nichia-614 discloses “said layer having a substantially uniform thickness of less than 100 μ m over said die.” Pet. 31–33.

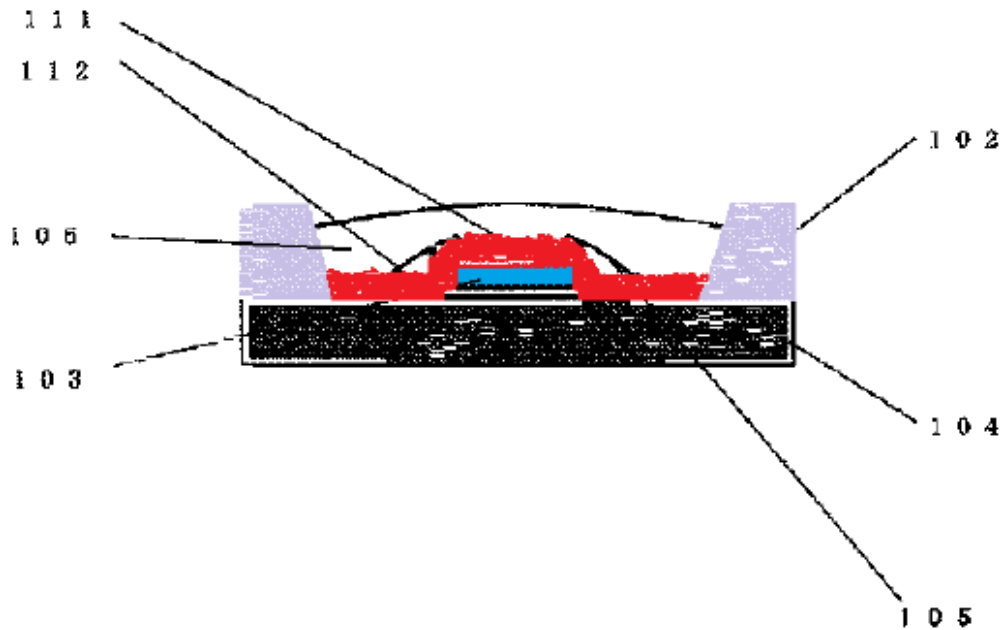
e. The Reflecting Cup

Claim 1 recites, in part, “a reflecting cup comprising reflective sidewalls, said die being located in said cup such that a portion of said light generated by said die is reflected from said cup.” Ex. 1001, 5:36–6:1.

Petitioner addresses this limitation in two ways.

(1) Petitioner’s First Rationale

Petitioner asserts that Nichia-614 expressly discloses a cup that reflects light. Pet. 33–34. Nichia-614’s Figure 2, below, shows package 102 with a cup. *Id.* at 34.



Nichia-614’s Figure 2, shown above with Petitioner’s annotations, is a schematic cross-sectional diagram of an LED chip (103) mounted on a package (102). *Id.*

The figure above shows a cup in purple and LED chip 103 in blue. *Id.* Nichia-614’s cup surrounds LED chip 103. *Id.*; Ex. 1014, Fig. 2. LED chip 103 emits high-energy light. Ex. 1014 ¶ 18. The paragraph quoted in the Petition expressly discloses that the emitted light is “reflected by a cup.” *Id.*, *quoted in* Pet. 34. In view of this express disclosure, we agree with Petitioner that Nichia-614 discloses a reflective cup, as recited in the claim, in at least this way. *See* Pet. 33–34.

We disagree with Patent Owner’s arguments to the contrary: Patent Owner asserts that Nichia-614’s sidewalls are “in a dark color system.” PO Resp. 24 (quoting Ex. 1014 ¶ 46); *see also* Sur-reply 16 (discussing the package’s dark color system described in Ex. 1014 ¶ 48). Patent Owner argues that “[n]othing in [paragraph 18 of Nichia-614] teaches that the sidewalls of the cup are reflective.” PO Resp. 23 (citing Baker Decl. ¶ 68). According to Patent Owner, “the purpose of this coloration is not to reflect

light, but to ‘provide a light shielding function,’” and “a POSITA knows that dark colors will absorb, not reflect light.” *Id.* at 24–25 (quoting Ex. 1014 ¶ 46).

Patent Owner’s argument suggests that the meaning of “reflective” turns on the designer’s subjective intent. *See id.* But subjective intent may not provide a clear standard to determine a claim’s scope. *See, e.g., Geneva Pharms., Inc. v. Glaxo-SmithKline PLC*, 349 F.3d 1373, 1384 (Fed. Cir. 2003). Even so, Nichia-614 expressly discloses that the emitted light is “reflected by a cup.” Ex. 1014 ¶ 18. That is, even under Patent Owner’s understanding, Nichia-614 discloses that the cup’s purpose is to reflect light. *See id.*

(2) *Petitioner’s Second Rationale*

Petitioner explains that, “[i]n addition to the express disclosure of a reflective cup,” Nichia-614’s reflector cup can be made of a gray material. Pet. 34; Doolittle Decl. ¶ 64. Nichia-614 supports this assertion by explaining that the dark color system includes the gray color:

A package 102 can [have] a plurality of opening parts in accordance with the number and size of the LED chips 103. In addition, in order to provide a light shielding function, it is colored in a dark color system such as black *or gray*, or the light emission observation surface side of the package 102 is colored in a dark color system.

Ex. 1014 ¶ 47 (emphasis added), *cited in* Pet. 34. Dr. Doolittle explains that a gray object is reflective. Doolittle Decl. ¶¶ 64–65. According to the Petition, “The variation in shade between white and black can be understood to comprise various degrees of reflectivity across the visible spectrum (i.e., color neutral reflectivity).” Pet. 34.

Patent Owner argues that Petitioner’s assertions about the gray cup are not adequately supported because (1) the assertions are not found within “the four corners” of Nichia-614, and (2) Dr. Doolittle’s opinions are “expert *ipse dixit*” that is entitled to no weight. Sur-reply 16. We disagree.

We find that Petitioner has shown that Nichia-614’s gray cup is reflective. In particular, Nichia-614 discloses that white light is produced by combining the color output by an LED with phosphor-converted light. Ex. 1014 ¶ 36, *cited in* Pet. 35. Nichia-614 explains that “light emitted from the LED chip 103 and the light emitted from the phosphor are in a complementary color relationship, white light can be emitted by mixing each light respectively.” *Id.* The Doolittle Declaration explains that the gray package would reflect at least some of the incident white light. Doolittle Decl. ¶ 65. Supported by Nichia-614’s disclosure that the device as a whole outputs white light (Ex. 1014 ¶ 36), the Doolittle Declaration explains that Nichia-614’s gray package, in particular, would provide light perceived as broad-spectrum white light instead of absorbing a specific part of the color spectrum. Doolittle Decl. ¶ 65. Considering these teachings and the Doolittle Declaration, we agree with Petitioner that Nichia-614 discloses a reflective cup in this additional way. Pet. 34–35.

Although Dr. Baker disagrees whether the gray-cup embodiment would be “reflective” under Patent Owner’s understanding of the term, Dr. Baker acknowledges that Nichia-614’s “cup should reflect the light.” Ex. 1032, 141:5–142:9. A cup that reflects light is sufficient to meet the limitation at issue. Because the Baker Declaration is based on Patent Owner’s narrow reading of the term and is insufficiently supported by Nichia-614, we assign the contrary opinions in the Baker Declaration little weight on this issue. *See, e.g.*, Baker Decl. ¶ 68.

Thus, considering the entire record, we find that Petitioner has shown that the gray walls reflect at least some light, and Nichia-614's gray cup is "a reflecting cup comprising reflective sidewalls." Pet. 34. In reaching our decision, we credit the Doolittle Declaration on this point. Doolittle Decl. ¶¶ 64–65.

Also, the Petition relies on a gray-colored package as an alternative rationale, and Petitioner's primary theory is that Nichia-614 expressly discloses that LED chip 103 emits high-energy light that is "reflected by a cup." Pet. 34 (quoting Ex. 1014 ¶ 18). In fact, taken together, Petitioner's first and second rationales support each other. Thus, Petitioner has shown two ways that Nichia-614 discloses "a reflecting cup comprising reflective sidewalls, said die being located in said cup such that a portion of said light generated by said die is reflected from said cup," as recited in the claim. *See id.* at 33–35.

f. "said layer of phosphor particles covering a portion of said reflective sidewalls"

Claim 1 recites, in part, "said layer of phosphor particles covering a portion of said reflective sidewalls." Ex. 1001, 5:36–6:3.

As for this limitation, Petitioner asserts that "figure 2 of Nichia-614 shows the layer of phosphor particles covering a portion of the reflective sidewalls." Pet. 34. According to Nichia-614, coating layer 112 is on the support, and the layer is about 20 µm thick. Ex. 1014 ¶¶ 16, 74, *quoted in* Pet. 32–33.

Patent Owner argues that Nichia-614's layer 111 "only teaches to one of skill in the art that the red coating layer 111 intersects with sidewalls 102 in the same thickness that it covers the bottom surface of the LED." PO Resp. 22 (citing Baker Decl. ¶ 66). In Patent Owner's view, because "[t]here

is no disclosure that the coating layer 111 extends up the sidewalls beyond this point,” coating layer 111 is not “covering a portion of said side walls” under the correct construction. *Id.* at 22–23. We disagree.

Patent Owner’s construction is too narrow. For the reasons discussed in the *Claim Construction* Section, we construe “covering a portion of sidewalls” within the full scope of its plain and ordinary meaning, which does not limit the size of portion covering the sidewalls. *See supra* § II.C.1.c (discussing the term’s plain and ordinary meaning and addressing Patent Owner’s arguments). Because claim 1 does not impose a lower limit on the amount of sidewall covered by the layer of phosphor, claim 1 encompasses a layer that covers the sidewall with the same thickness that the layer covers the bottom surface of the LED. *Id.*

Under this construction, we find the recited layer encompasses Nichia-614’s layer 111, which covers the portion of sidewall 102 at least where layer 111 and sidewall 102 intersect. *See id.*⁴ In particular, Nichia-614’s Figure 2, below with annotations, shows layer 112 touching the reflector cup. *See* Ex. 1014, Fig. 2.

⁴ Patent Owner disagrees with Petitioner over whether the phosphor layer curves above the rest of the layer that covers the bottom surface. *See* Pet. Reply 14; Sur-reply 14–15. We need not resolve this issue because the claim at least encompasses a layer that covers the sidewall with the same thickness that the layer covers the bottom surface of the LED.



A cropped and enlarged version of Petitioner’s annotated version of Figure 2 is shown above. Pet. 34.

The cropped and enlarged version of the figure from the Petition, above, shows layer 111 in red touching the reflecting cup in purple, which has reflective sidewalls. *Id.*; *see also supra* § II.D.2.e (discussing the cup’s reflectivity).

Thus, we find that Petitioner has shown that Nichia-614 discloses “said layer of phosphor particles covering a portion of said reflective sidewalls.”

g. Conclusion

We determine that Petitioner has shown by a preponderance of the evidence that Nichia-614 anticipates claim 1.

3. Claim 2

a. The Light Source

Like claim 1, claim 2 recites, in part, “a light source that generates light of a first wavelength.” Ex. 1001, 6:5–6. Petitioner asserts that the analysis for claim 1 applies here. Pet. 36. As discussed in the section

analyzing claim 1, we find that Petitioner has shown that Nichia-614 discloses a light source that generates light of a first wavelength. *Supra* § II.D.2.a.

b. The Layer of Phosphor Particles

Claim 2 recites, in part, “a layer of phosphor particles covering said light source, said phosphor particles converting at least a portion of said light of said first wavelength to light of a second wavelength.” Ex. 1001, 6:7–10. Claim 1 recites a layer with similar limitations. *Compare id.*, with *id.* at 5:31–35 (claim 1). For the reasons discussed above in connection with claim 1, we find that Petitioner has shown that Nichia-614 discloses this layer. *See supra* § II.D.2.

Petitioner asserts that “even if the process recited in element 2[b] is narrowly interpreted to require a conformal layer that is substantially uniform in thickness . . . those physical requirements are also met by Nichia-614.” Pet. 37. For the reasons discussed above in connection with claim 1, we find that Petitioner has shown that Nichia-614’s layer is “conformal” and “substantially uniform in thickness.” *See supra* §§ II.D.2.b–d.

c. The Residue

Claim 2 further recites that “said layer comprising a residue of a slurry of said phosphor particles in a volatile solvent, said residue comprising the portion of said slurry that remains when a portion of said volatile solvent is removed.” Ex. 1001, 6:10–14 (the “residue feature”). Petitioner argues that this is a non-limiting product-by-process limitation. Pet. 18–19; *see also* Pet. 37 (questioning the relevance of this limitation). We, however, need not determine whether this is the case because we find that Petitioner has shown that Nichia-614 teaches the recited residue feature. *Id.* at 37–38.

In particular, Nichia-614 describes preparing “a mixed solution of an ethyl silicate hydrolyzed solution, ethylene glycol and a phosphor in a weight ratio of 1:1:1.” Ex. 1014 ¶ 66, *quoted in* Pet. 37. Petitioner asserts that ethylene glycol is the solvent. Pet. 37 (citing Ex. 1014 ¶ 66). According to Nichia-614, the coating liquid is adjusted and stirred to uniformly disperse the phosphor. Ex. 1014 ¶ 66. In the paragraph cited by Petitioner, Nichia-614 further explains that, after the coating is dried, the solvent is completely evaporated. *Id.* ¶ 73, *quoted in* Pet. 38. Thus, Petitioner has shown that Nichia-614’s remaining coating is a residue of the 1:1:1 slurry of phosphor particles after the volatile solvent evaporates. *See* Pet. 38.

Patent Owner does not substantively address Petitioner’s arguments and evidence regarding claim 2. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues that the Petition’s analysis of claim 2 is deficient for the same reasons as the analysis for claim 1:

The Petition and Dr. Doolittle fail to show that Nichia-614 discloses a “layer phosphor particles” as required by limitation 2[b] for the same reasons they fail to show a “layer of phosphor particles” for limitation 1[b] as discussed above. With respect to showing that this layer is “conformal” and “substantially uniform in thickness” as required by the Alternative Physical Construction, the Petition and Dr. Doolittle rely on their analysis of the corresponding limitations of claim 1. Petition at 37; Ex. 1007, Doolittle Decl., ¶37. Accordingly, their arguments as to claim 2 fail for the same reasons.

PO Resp. 25. For the reasons discussed in the section analyzing claim 1, we disagree. *Supra* § II.D.2.

We determine that Petitioner has shown by a preponderance of the evidence that Nichia-614 anticipates claim 2.

4. *Claim 3*

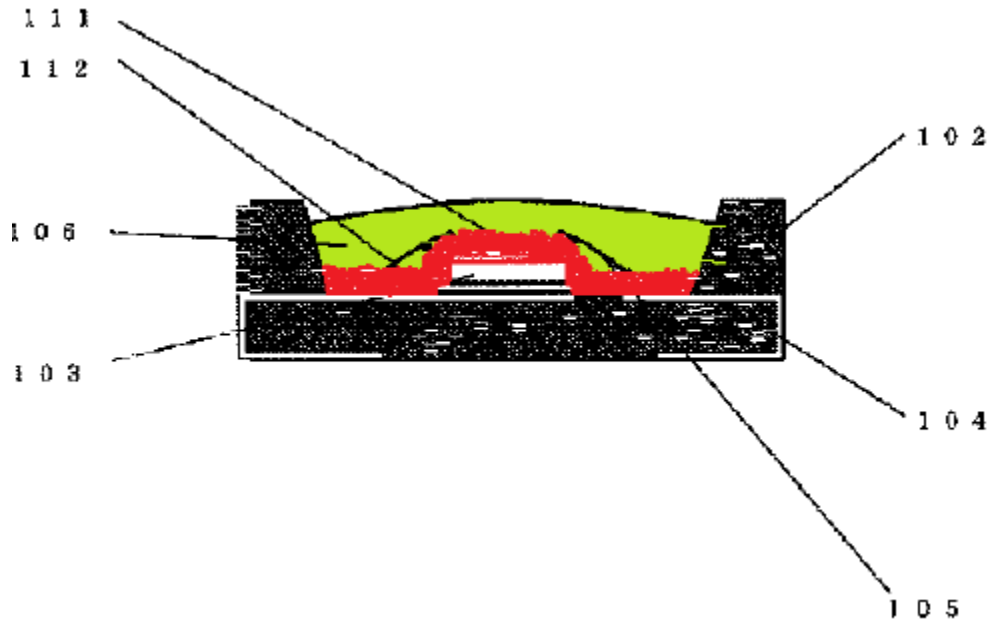
Claim 3 recites, “The light emitting device of claim 2 wherein said light source comprises an LED.” Ex. 1001, 6:16–17. Petitioner asserts that Nichia-614’s reference number 103 in Figure 2 points to an LED that corresponds to the recited light source. Pet. 38. In support of this assertion, Petitioner cites a paragraph of Nichia-614 that describes 103 as an LED chip. Ex. 1014 ¶ 16, *cited in* Pet. 38. We find that Petitioner has shown that Nichia-614 discloses the recited LED light source.

Patent Owner does not substantively address Petitioner’s arguments and evidence about claim 3. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues that “the Petition and Dr. Doolittle fail to show that Nichia-416 anticipates [claims 3, 4, and 7] at least because they fail to show that Nichia-614 discloses all of the limitations of Claim 2 as discussed above.” PO Resp. 25. For the reasons discussed in the section analyzing claim 2, we disagree. *Supra* § II.D.3.

We determine that Petitioner has shown by a preponderance of the evidence that Nichia-614 anticipates claim 3.

5. *Claim 4*

Claim 4 recites, “The light emitting device of claim 2 further comprising a layer of clear material covering said layer of phosphor particles.” Ex. 1001, 6:17–19. Petitioner asserts that mold member 106 shown in Nichia-614’s Figure 2, below, corresponds to the recited clear material. Pet. 39.



Nichia-614’s Figure 2, shown above with Petitioner’s annotations, is a schematic cross-sectional diagram of an LED chip (103) mounted on a package (102) with a mold member (106). *Id.*

The figure above shows mold member 106 in green. *Id.* According to the paragraph cited by Petitioner, mold member 106 is formed from transparent resin or glass. Ex. 1014 ¶ 52, *cited in* Pet. 39. Thus, we find that Petitioner has shown that Nichia-614 discloses the “layer of clear material” recited in claim 4.

Patent Owner does not substantively address Petitioner’s arguments and evidence regarding claim 4. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues that “the Petition and Dr. Doolittle fail to show that Nichia-416 anticipates [claims 3, 4, and 7] at least because they fail to show that Nichia-614 discloses all of the limitations of Claim 2 as discussed above.” PO Resp. 25. For the reasons discussed in the section analyzing claim 2, we disagree. *Supra* § II.D.3.

We determine that Petitioner has shown by a preponderance of the evidence that Nichia-614 anticipates claim 4.

6. *Claim 7*

Claim 7 recites, “The light emitting device of claim 2 further comprising a reflecting cup comprising reflective sidewalls, a die located in said cup such that a portion of said light generated by said die is reflected from said cup, said layer of phosphor particles covering a portion of said reflective sidewalls.” Ex. 1001, 6:28–32. Petitioner asserts that there is “no substantive difference between claim 7 and the final element of claim 1.” Pet. 40. We agree. Petitioner relies on the same analysis here as presented for the corresponding limitation in claim 1, which Petitioner shows to be disclosed by Nichia-614. *See supra* § II.D.2.e. For the same reasons discussed above, we also find that Petitioner has shown that Nichia-614 discloses the reflecting cup recited in claim 7. *Id.*

Patent Owner does not substantively address Petitioner’s arguments and evidence regarding claim 7. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues that “the Petition and Dr. Doolittle fail to show that Nichia-416 anticipates [claims 3, 4, and 7] at least because they fail to show that Nichia-614 discloses all of the limitations of Claim 2 as discussed above.” PO Resp. 25. For the reasons discussed in the section analyzing claim 2, we disagree. *Supra* § II.D.3.

We determine that Petitioner has shown by a preponderance of the evidence that Nichia-614 anticipates claim 7.

E. *Claim 5: Obviousness over Nichia-614 and Nichia-341*

Claim 5 recites, “The light emitting device of claim 4 wherein said clear material further comprises a diffusing material for scattering light generated by said light source and said phosphor particles.” Ex. 1001, 6:21–24.

Petitioner asserts that Nichia-614 “specifically links the diffusing agent to the output from the LED 103” but does not expressly link “to the wavelength converted output from the phosphor particles is provided.”

Pet. 41. According to Petitioner, it would have been obvious to use a conventional diffusing agent that scattered both types of light. *Id.* Petitioner asserts that Nichia-341 discloses various diffusing agents that may be added to the light transmitting resin provided over a light emitting diode. *Id.* at 41–42 (citing Ex. 1015 ¶¶ 232–236; Doolittle Decl. ¶ 78).

Here, we determine that Petitioner provides articulated reasoning, supported by rational underpinnings, why one of ordinary skill in the art would have made the proposed combination. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Based on Petitioner’s analysis, we find that a person of ordinary skill in the art would have combined Nichia-614 and Nichia-341 and this combination would have been within the level of ordinary skill in the art. *Id.*

In particular, Petitioner explains that “Nichia-341 provides reasons for scattering both the light from the LED and the wavelength converted light—to suppress uneven color, provide good directivity, and improve color uniformity.” Pet. 43 (citing Ex. 1015 ¶¶ 27, 198, 235; Doolittle Decl. ¶ 79). Petitioner asserts that “the diffusing agent ensures that both the light from the LED and the wavelength converted light are spread more evenly to provide a broader and more consistent color output from the device.” *Id.* Petitioner supports the obviousness rationale by citing Nichia-614’s discussion of “color tone unevenness.” *Id.* (citing Ex. 1014, Abstract). In Petitioner’s view, “the specific use for which the diffusing agent was used in Nichia-614—diffusing the light output to relax directivity—applies directly to the light from both the LED and the wavelength converting particles.” *Id.*

Patent Owner does not substantively address Petitioner’s arguments and evidence regarding claim 5. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues, “Because they fail to show that Nichia-614 anticipates or renders obvious all of the limitations of claim 2 as discussed above, they therefore likewise fail to show Nichia-614 in view of Nichia-341 renders obvious the additional limitations of claim 5.” PO Resp. 26. For the reasons discussed in the section analyzing claim 2, we disagree. *Supra* § II.D.3.

Upon review of the entirety of the record, we are persuaded by Petitioner’s evidence and obviousness analysis, and we credit Dr. Doolittle’s testimony on this issue. Pet. 40–44; Doolittle Decl. ¶¶ 78–79. Thus, we determine that Petitioner has shown by a preponderance of the evidence that that claim 5 is unpatentable as obvious over Nichia-614 and Nichia-341. *See* Pet. 40–44.

F. Claim 6: Obviousness over Nichia-614, Nichia-341, and Koike

Claim 6 recites, “The light emitting device of claim 5 further comprising a layer of transparent bulk encapsulating material over said layer of clear material.” Ex. 1001, 6:25–27.

According to Petitioner, Koike discloses a layer of transparent material (27) containing a diffusing agent for scattering light, and an additional transparent encapsulating material (28) provided over layer 27. Pet. 44–45 (citing Ex. 1017, 6:1–54; Doolittle Decl. ¶¶ 84–85). Petitioner analyzes Koike’s encapsulating materials and their purpose. *See id.* at 45 (citing Ex. 1017, 6:1–54; Doolittle Decl. ¶¶ 84–85). According to Petitioner, “A person having ordinary skill in the art, therefore, would have had reason to use a bulk encapsulating layer as disclosed in Koike positioned above a transparent layer containing a diffusing agent as disclosed in Nichia-614 in

order to improve the light distribution from the device and/or to provide additional protection to the device.” *Id.* at 48 (citing Doolittle Decl. ¶ 87).

Here, we determine that Petitioner provides articulated reasoning, supported by rational underpinnings, why one of ordinary skill in the art would have made the proposed combination. *See KSR*, 550 U.S. at 418. Based on Petitioner’s analysis, we find that a person of ordinary skill in the art would have combined Nichia-614 and Nichia-341 with Koike, and this combination would have been within the level of ordinary skill in the art. *Id.*

For example, Petitioner asserts that “Koike discloses a number of benefits provided by the bulk encapsulating layer (28) provided over the transparent layer (27) containing a diffusing agent.” Pet. 46. Petitioner supports this assertion with a detailed analysis of Koike, Nichia-614, and explanations from the Doolittle Declaration. *Id.* at 46–48 (citing Ex. 1014 ¶ 1; Ex. 1017, 6:1–54; Doolittle Decl. ¶¶ 85–87).

In the passages cited in the Petition, Koike teaches that a bulk encapsulating layer may be shaped as a converging lens for light gathering. Ex. 1017, 6:33–54. Citing the Doolittle declaration, Petitioner explains that, by shaping the lens using a separate layer of material above the package as described by Koike, “there is freedom to shape the lens to provide a broader array of optical properties.” Pet 46 (citing Doolittle Decl. ¶ 85). Koike describes other benefits, such as protection from discoloration or aging, which Petitioner relies upon in its obviousness rationale. Ex. 1017, 6:14–32; *see also* Pet. 47–48 (discussing aging and outdoor uses).

Patent Owner does not substantively address Petitioner’s arguments and evidence regarding claim 6. *See* PO Resp.; Sur-reply. Rather, Patent Owner argues, “Because [Petitioner] fails to show that Nichia-614 and Nichia-341 render obvious the limitations of claim 5 as discussed above,

they likewise therefore fail to show Nichia-614 in view of Nichia-341 in further view of Koike renders obvious the additional limitations of claim 6.” PO Resp. 26. For the reasons discussed in the sections analyzing claims 2 and 5, we disagree. *Supra* §§ II.D.3., II.E.

Upon review of the entirety of the record, we are persuaded by Petitioner’s evidence and obviousness analysis, and we credit the testimony of Dr. Doolittle. Pet. 44–48; Doolittle Decl. ¶¶ 84–87. Thus, we determine that Petitioner has shown by a preponderance of the evidence that claim 6 is unpatentable as obvious over Nichia-614, Nichia-341, and Koike. *See* Pet. 44–48.

G. Remaining Grounds

Petitioner presents additional, cumulative challenges to claims 1–7: Petitioner asserts that claim 1 is unpatentable as obvious over Matsushita alone or Matsushita in combination with Nichia-614. Pet. 48–53. Petitioner also asserts that claims 1–7 are unpatentable as anticipated by, or obvious over, Nichia-341. *Id.* at 53–69.

Because we determine that claims 1–7 are unpatentable for the reasons discussed above, we do not separately assess the patentability of these claims based on the remaining grounds in this proceeding. *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”); *Boston 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”).

III. CONCLUSION

Petitioner has met its burden to show that claims 1–7 are unpatentable.⁵

Claim(s)	35 U.S.C. §	Reference(s)	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–4, 7	102(b)	Nichia-614	1–4, 7	
5	103(a)	Nichia-614, Nichia-341	5	
6	103(a)	Nichia-614, Nichia-341, Koike	6	
1	103(a) ⁶	Matsushita, Nichia-614		
1–7	102(b)/103(a) ⁷	Nichia-341		
Overall Outcome			1–7	

⁵ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this 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).

⁶ We do not reach this ground. *See supra* § II.G.

⁷ We do not reach this ground. *See supra* § II.G.

IV. ORDER

It is

ORDERED that claims 1–7 of the U.S. Patent 7,315,119 B2 are unpatentable; and

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

IPR2020-00938
Patent 7,315,119 B2

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