

Oral Hearing: Patent Owner's Demonstrative Exhibits

IPR2024-01357; IPR2025-00260

Patent No. 8,604,678

February 26, 2026

Demonstrative Only – Not Evidence



Instituted Grounds

Petition	Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
IPR2024-01357	1	1-3, 6, 7, 9, 10, 16-21, 25, 26	103	Basin-2007, Basin-2005
IPR2024-01357	2	19, 20, 29	103	Hussell, Basin-2007, van Woudenberg
IPR2024-01357	3	1-3, 6, 10, 19, 21, 25	103	Krummacher, Shimizu, Stokes
IPR2024-01357	4	19, 20, 29	103	Hussell, Krummacher, van Woudenberg
IPR2025-00260	1	11-14	103	Basin-2007, Basin-2005
IPR2025-00260	2	11-14	103	Basin-2007, Basin-2005, Stokes
IPR2025-00260	3	11-14	103	Krummacher, Shimizu, Stokes

IPR2024-01357, Paper 17, at 4-5;
IPR2025-00260, Paper 17, at 3-4.

Topics

- 1.Claim Construction
- 2.Secondary Indicia of Non-Obviousness
- 3.Witness Credibility
- 4.Patentability: IPR2024-01357 Grounds 1-4
- 5.Patentability: IPR2024-00260 Grounds 1-3
- 6.Contingent Motion to Amend

Claim Construction

Claim Construction – “Light Diffusing Layer”



In sum, for purposes of determining whether to institute trial, we construe the phrase “light diffusing layer” as “a layer that diffuses light,” and the layer must “improve[] an off-state white appearance of the wavelength conversion component.” But we will not read other purposes into the claims.

IPR2024-01357, Paper 17, at 20.

Patentability: All Grounds

Secondary Indicia of Non-Obviousness
Undermine Petitioners' Alleged Motivation to Combine

Paper 26, IPR2024-01357 PO Resp, at 47-51;
Paper 34, IPR2025-00260 PO Resp, at 44-48;
Paper 45, PO Surreply, at 12-14.

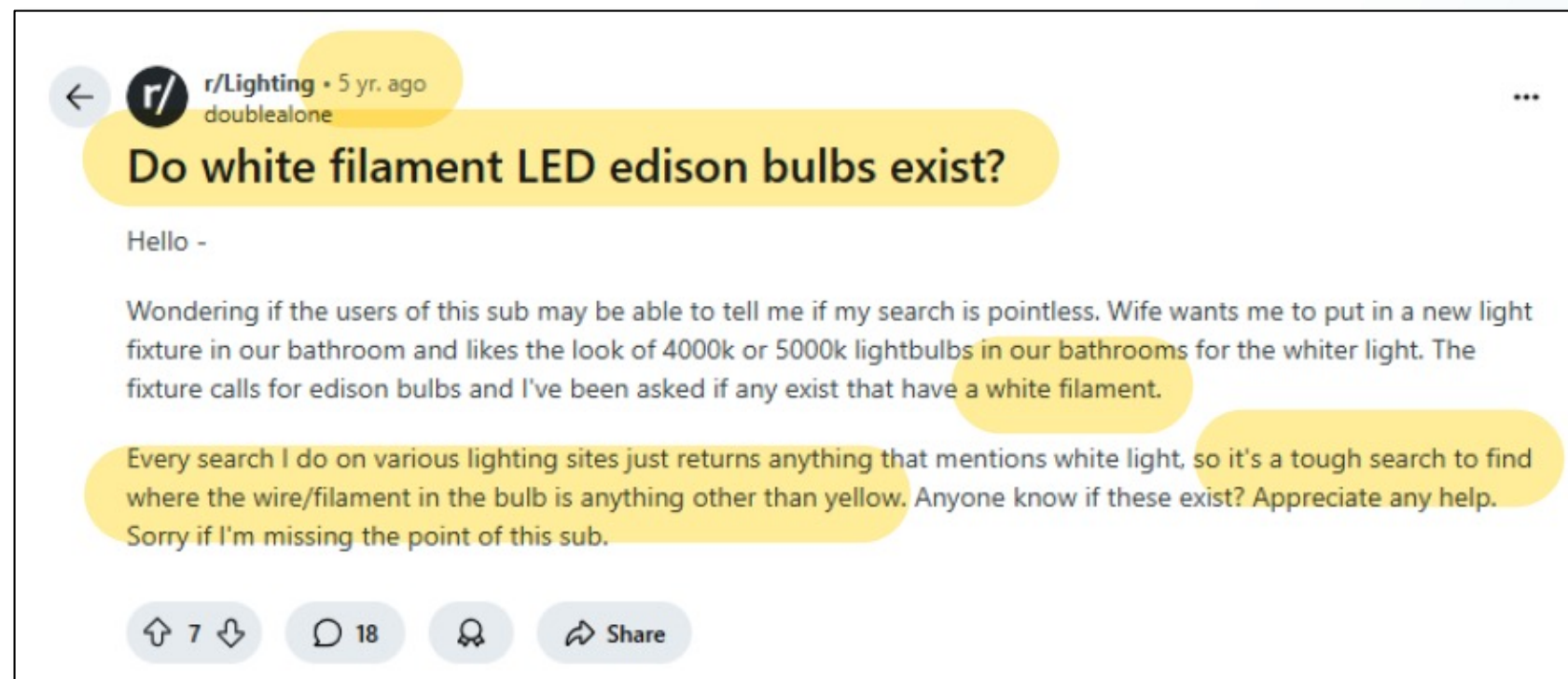
Satisfying a Long-Felt Need

Satisfying a long-felt but unresolved need. “Evidence of a long felt but unresolved need tends to show non-obviousness because it is reasonable to infer

that the need would have not persisted had the solution been obvious.” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1332 (Fed. Cir. 2016). The ’678 Patent itself identifies the long-felt need for the claimed invention. In particular, the ’678 Patent explained that “there is a need for an improved approach to implement LED lighting apparatuses which addresses the non-white color appearance of the LED lighting apparatuses while in an OFF state.” EX1001 at 2:46-52; *see also* EX2037 (expressing a need for white filament lighting devices); EX2026, ¶ 139. The existence of this long-felt need is further evidenced by the commercial success, unexpected results, and industry praise that Patent Owner’s patented products have enjoyed, as well as the many copycat products that now compete against Patent Owner’s products.

Paper 26, IPR2024-01357 PO Resp., at 47-48;
see also Paper 34, IPR2024-00260 PO Resp. at 44-45;
Paper 45, PO Surreply at 12-14.

Satisfying a Long-Felt Need



Ex. 2037.

Achieving Commercial Success

Achieving commercial success. “Demonstrating that an invention has commercial value, that it is commercially successful, weighs in favor of its non-obviousness.” *WBIP*, 829 F.3d at 1337. Since the first introduction of its patented white-filament bulbs, Patent Owner has prominently advertised the feature in its marketing and sales materials. *See* EX2032, EX2033, EX2034; *see also* EX2026, ¶ 137. Retailers who sell Patent Owner’s patented products have likewise emphasized the white filaments. *See* EX2029 (indicating that “These clear glass LED bulbs with exposed white filament offer a sleek aesthetic that easily assimilates into any home décor style. Where traditional clear glass LED bulbs

Paper 26, IPR2024-01357 PO Resp., at 48.

stand out with their yellow filaments, these bulbs contain a discreet, white-colored core that blends in better, while still providing a smooth glow meant for chandeliers, pendants, and lamps without shades.”), EX2031, EX2035; *see also* EX2026, ¶¶ 136, 138. Those retailers have also priced Patent Owner’s patented products at a premium compared to similar bulbs with yellow filaments, demonstrating that customers desire and appreciate the white filament and are willing to pay more for it. *Compare* EX2035 (Patent Owner’s white-filament product priced at \$29.97) *with* EX2036 (similar yellow-filament product priced at \$21.97); *see also* EX2026, ¶ 138.

Paper 26, IPR2024-01357 PO Resp., at 49;
see also Paper 34, IPR2024-00260 PO Resp. at 46;
Paper 45, PO Surreply at 12-14.

Generating Industry Praise

Generating industry praise. In addition to commercial success, Patent Owner's patented white-filament bulbs have received praise from the industry. For example, Home Depot last year announced Patent Owner's patented white-filament bulbs as one of its 2024 Innovation Awards Winners, specifically emphasizing that they "help create a timeless look by blending into any décor with lower profile white filaments." EX2031; *see also* EX2026, ¶ 136. Industry forums also tout the benefits of Patent Owner's white filament products, noting that "[t]he white filaments make the bulb look less obtrusive when it's off." EX2030. This is the very response the '678 Patent inventors sought to achieve. *See* EX1001 at 11:15-22.

Paper 26, IPR2024-01357 PO Resp., at 49;
see also Paper 34, IPR2024-00260 PO Resp. at 46;
Paper 45, PO Surreply at 12-14.

Drawing Copycat Products From Competitors

Drawing copycat products from competitors. As the Board is aware, the subject proceeding was filed in response to district court actions asserting the '678 Patent against Petitioners' products. *See* Pet. at 16-17. Specifically, Petitioners' accused white filament products all infringe the '678 patent, all were introduced after Patent Owner's patented products, and all mirror Patent Owner's own white filament design. *See* EX1018, EX1037, EX1038, EX1039. This copying of the invention shows that the challenged claims are not obvious. *See Akamai Techs., Inc. v. Cable & Wireless Internet Servs., Inc.*, 344 F.3d 1186, 1196 (Fed. Cir. 2003). If the claims were obvious as Petitioners claim, then Petitioners would have introduced their competing products years earlier to meet the long-felt need.

Paper 26, IPR2024-01357 PO Resp., at 50;
see also Paper 34, IPR2024-00260 PO Resp. at 46-47;
Paper 45, PO Surreply at 12-14.

Providing Unexpected Results

Providing unexpected results. Petitioners assert that the claimed invention is nothing more than the expected result of combining various prior art teachings. The market shows otherwise. If the claimed invention were as obvious and expected as Petitioners contend, then they and others would have introduced white-filament LED bulbs to the market long before 2010 to meet the demonstrated consumer demand. See EX2029, EX2030, EX2031, EX2032, EX2033, EX2034, EX2037. The fact that none of the Petitioners did so demonstrates that the results were *unexpected*.

Paper 26, IPR2024-01357 PO Resp., at 50;
see also Paper 34, IPR2024-00260 PO Resp. at 47;
Paper 45, PO Surreply at 12-14.

Demonstrated Nexus

Demonstrated Nexus. “[T]here is a presumption of nexus for objective considerations when the patentee shows that the asserted objective evidence is tied to a specific product and that product ‘is the invention disclosed and claimed in the patent.’” *WBIP*, 829 F.3d at 1329. Each of the above listed secondary considerations is directly related to white filament style light emitting devices, including Petitioners’ products that practice the claimed invention (*see* EX1018, EX1037, EX1038, EX1039).

Paper 26, IPR2024-01357 PO Resp., at 50-51;
see also Paper 34, IPR2024-00260 PO Resp. at 47-48;
Paper 45, PO Surreply at 12-14.

Patentability: All Grounds

Witness Credibility – Professor Doolittle

Paper 26, IPR2024-01357 PO Resp, at 25-29;
Paper 45, PO Surreply, at 14-15.

Professor Doolittle Contradicted Himself

A. Prof. Doolittle's Contradictory Testimony on Claim Construction

For example, Prof. Doolittle testified in this proceeding that “for all of the claim terms considered in this declaration, I have applied the plain and ordinary meaning of those terms unless otherwise specifically indicated.” EX1002, ¶ 32. Nowhere in Prof. Doolittle's declaration did he “specifically indicate” that he applied anything other than the plain and ordinary meaning. During cross examination, Prof. Doolittle could not recall any claim term for which he did *not* apply the plain and ordinary meaning. EX2025 at 17:7-18. Of course, this necessarily means that Prof. Doolittle was able to understand and apply the plain and ordinary meaning of every claim term.

Paper 26, IPR2024-01257 PO Resp., at 26.

Yet, Prof. Doolittle took the opposite position under oath in a parallel district court proceeding. There, Prof. Doolittle opined that certain claim terms are indefinite, meaning that he was unable to determine any plain and ordinary meaning. *See generally* EX2025 at 19:2 – 22:9, 24:7 – 50:4. In one example, Prof. Doolittle told the district court under oath that the claim term “improves an off-state white appearance of the wavelength conversion component” is indefinite. EX2025 at 36:18 – 40:1; EX2024, ¶ 12; *see also* EX2025 at 21:7 – 22:9, 24:7 – 25:7; EX2023, ¶ 66 *et seq.* In another example, Prof. Doolittle told the district

Paper 26, IPR2024-01257 PO Resp., at 26.

Professor Doolittle Repeatedly Dodged Questions

B. Prof. Doolittle's Nonresponsive and Obstructionist Testimony

Beyond his inexplicable contradictions on claim construction, Prof. Doolittle repeatedly dodged questions and tried to shoehorn new and nonresponsive opinions into his answers to Patent Owner's questions. During cross examination Patent Owner was forced to object to Prof. Doolittle's nonresponsive answers no less than eighteen times. EX2025 at 22:10 – 23:15 (once), 25:9 – 26:14 (twice), 30:14-22 (once), 40:3-9 (once), 58:12 – 59:1 (once), 60:18 – 61:13 (once), 65:1-10 (once), 83:15 – 84:16 (once), 92:15 – 95:20 (three times), 96:18 – 99:9 (twice), 102:22 – 106:16 (twice), 135:3 – 136:22 (twice). In many of these instances, Prof. Doolittle dodged the question and then tried to inject new and nonresponsive arguments that he had not disclosed in his declaration. *Id.*

Paper 26, IPR2024-01257 PO Resp., at 27.

Patentability: IPR2024-01357 Ground 1

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Basin-2007 and Basin-2005

Paper 26, IPR2024-01357 PO Resp, at 30-36;
Paper 45, PO Surreply, at 2-8, 10-11.

Petitioners Rely Solely on Professor Doolittle for the Alleged Motivation to Combine

A. Ground 1: Petitioners Have Not Shown that a POSITA Would Have Been Motivated to Combine Basin-2007 and Basin-2005

Petitioners have failed to establish that a POSITA would have been motivated to combine Basin-2007 with Basin-2005 for several reasons. EX2026, ¶¶ 104-16. Petitioners rely exclusively on the testimony of Prof. Doolittle, who fails to address the very different lighting applications disclosed in Basin-2007 and Basin-2005 or explain why one of ordinary skill in the art would have selectively combined the cited teachings from these references. In addition, as discussed

Paper 26, IPR2024-01357 PO Resp., at 30.

Petitioners Acknowledge That Basin-2007 Did *Not* Teach Blue Light With Wavelength > 440nm

Petitioners rely on Basin-2007 for Ground 1, but they acknowledge that Basin-2007 did not teach blue light at the specifically claimed wavelength equal to or greater than 440 nm. *See generally* Pet. at 19-39; EX2023 at 126:6-139:12. Relying solely on Prof. Doolittle's say-so, Petitioners argue that "[a POSITA]

Paper 26, IPR2024-01357 PO Resp., at 30.

Basin-2007 discloses every element in challenged claims 1-3, 6, 7, 9, 10, 16-21, 25, and 26 with one exception: it does not specifically disclose that the LED chip emits blue light at a wavelength of greater than or equal to 440 nm. But LED

Paper 1, IPR2024-01357 Petition, at 19.

Petitioners Fail to Address the Different Applications of Basin-2007 and Basin-2005

Further, a POSITA would not have been motivated to combine Basin-2007 and Basin-2005 in the particular way Petitioners allege with a reasonable expectation for success because these references provide solutions for entirely

different LED applications. Basin-2007 is generally directed to LEDs used in momentarily energized lighting devices (*i.e.*, camera flashes) (*see, e.g.*, EX1005, ¶ 3), whereas Basin-2005 discusses LEDs used in long energization or outdoor environments (*i.e.*, headlamps for automobiles) (*see, e.g.*, EX1006, ¶ 10). EX2026, ¶¶ 62, 111. LEDs with momentarily energized lighting needs such as camera flashes require a quick response to the energization stimuli. EX2026, ¶¶ 62, 111. In contrast, LEDs used for long energization periods or in outdoor environments do not require an instantaneous perception of the light being used. *Id.* These differences lead to diverging approaches to LED design and packaging. *Id.*

Paper 26, IPR2024-01357 PO Resp., at 32-33.

Professor Doolittle Provided *No Analysis* of the Differences in LED Applications and Packaging

Petitioners' expert, Prof. Doolittle, was unable to point to a single instance in his sworn testimony where he analyzed the rationale for combining these references in light of their completely different intended applications. EX2023 at 84:20-85:11

("Q: is there any place in your declaration that you talked about the motivation for one of ordinary skill in the art to combine the teachings involving a flash lamp, a camera flash, with the teach—with other teachings involving an automobile headlight? A: I—I find the question irrelevant to the claims that I was analyzing."). Prof. Doolittle overlooks the fact that the application is important

Paper 26, IPR2024-01357 PO Resp., at 33; see also Ex. 2026, ¶¶ 61, 111 (Dr. Schubert addressing the differences in LED applications and packaging).

Recognizing the Lack of Motivation to Combine, Petitioners Improperly Tried to Add New Grounds

A. Petitioners' attempt to unfairly add new grounds to the Petition is in direct violation of the Board's rules and should be denied

Recognizing that the Petitions fail to demonstrate a clear motivation to combine the asserted references, **Petitioners now seek to introduce new arguments**

based on alleged single-reference obviousness grounds. These new grounds were neither included in the Petition nor instituted, as shown below by the list of grounds on which the Board instituted in IPR2024-01357 and IPR2025-00260.

Paper 45, PO Surreply, at 3.

Reply to Patent Owner Response

*"The Petition presented multiple paths to obviousness with respect to the blue LED chip emitting light at wavelengths greater than 440 nm, including: (1) the primary references disclose conventional blue LED chips, which would be understood to emit light at wavelengths greater than 440 nm based on the knowledge of a POSITA, as confirmed by the secondary references, **rendering the claims obvious over the primary references alone**; and (2) the secondary references disclose conventional blue LED chips that explicitly emit light at wavelengths greater than 440 nm, and it would have been obvious to use such conventional blue LED chips in the conventional blue-pumped white LEDs described in the primary references."* Reply at 8-9 (emphasis added).

Paper 45, PO Surreply, at 4.

Patentability: IPR2024-01357 Ground 2

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Hussell, Basin-2007, and Van Woudenberg

Paper 26, IPR2024-01357 PO Resp, at 36-41;
Paper 45, PO Surreply, at 5-8, 10-12.

Petitioners Again Rely Solely on Professor Doolittle for the Alleged Motivation to Combine

B. Ground 2: Petitioners Have Not Shown that a POSITA Would Have Been Motivated to Combine Hussell in view of Basin-2007 and Van Woudenberg.

Petitioners have failed to establish that a POSITA would have been motivated to combine Hussell, Basin-2007, and Van Woudenberg for several reasons. EX2026, ¶¶ 117-24. As with Ground 1, Petitioners rely exclusively on the testimony of Prof. Doolittle, who again fails to address the very different lighting applications disclosed in these three separate references or explain why one of ordinary skill in the art would have selectively combined the cited teachings from these references. In addition, as discussed above in Section VIII, Patent

Paper 26, IPR2024-01357 PO Resp., at 36.

Petitioners Again Fail to Address the Differences in Applications and Packaging

Regardless of Petitioners' claims, a POSITA would not be motivated to combine Hussell, Basin-2007, and Van Woudenberg because these references are directed to different applications of LEDs. Hussell involves conventional incandescent replacement applications (see EX1011, ¶ 3; EX2023 at 74:8-10), Basin-2007 involves momentarily energized lighting devices (i.e., camera flashes) using TFFCs (see EX1005, ¶ 3; see also EX2026, ¶¶ 87-88), and Van Woudenberg involves "auxiliary lights in mobile phones or down-light units" using DIP and

lead-frame SMD LEDs (see EX1020 at Abstract, FIG. 4; see also EX2026, ¶ 95). LED packaging varies depending on the LED and its application. See EX2026,

Paper 26, IPR2024-01357 PO Resp., at 37-38.

¶¶ 54-63, 119. Petitioners do not address how or why a POSITA would be motivated to apply Basin-2007's silicone encapsulant designed for momentarily energized lighting devices using TFFC configurations to Hussell's incandescent replacement application or Van Woudenberg's auxiliary lights using DIP or SMD LEDs beyond utilizing the same phosphor. A POSITA would not find it obvious to combine Hussell, Basin-2007, and Van Woudenberg's LEDs because both the structural differences of the LEDs themselves in addition to the differing applications from one reference to the next require vastly different packaging approaches that would prevent a POSITA from having the motivation to combine these references. EX2026, ¶¶ 54-63, 119. In short, neither Petitioners' nor Prof. Doolittle have identified any motivation for their proposed Frankenstein combination of features from these three disparate references.

Paper 26, IPR2024-01357 PO Resp., at 38.

Petitioners Again Fail to Address the Differences in Applications and Packaging—Even in Reply

4. Petitioners do not respond to Patent Owner's arguments regarding different LED packaging techniques

As explained in Patent Owner's Response and in Dr. Schubert's declaration, there are various forms of LED packaging, and the form has an effect on the light design and output. *See, e.g.*, Patent Owner Response to IPR2024-01357 (Paper 26) at 37-38; EX2026 at ¶¶ 42, 51-62, 109, 119, 128, 132. Petitioners do not address these differences in their Reply. It is Petitioners' burden to show (1) that one of skill in the art would have been motivated to combine this difference structures and (2) *how* one of skill in the art would have overcome these differences in order to arrive at the claimed invention. *See Tennent Co. v. Oxygenator Water Techs., Inc.*, IPR2021-00625, Paper 9 at 39 (P.T.A.B. Aug. 20, 2021) (criticizing petitioner for

Paper 45, PO Surreply, at 10.

Professor Doolittle Acknowledged the Challenges in Combining Remote and Non-Remote Phosphors

Petitioners also fail to explain how a POSITA would have overcome the various challenges to combining these three references. For example, a POSITA would not be motivated to combine Hussell with Basin-2007 or Van Woudenberg because Hussell is directed to remote-phosphor devices and Basin-2007 and Van Woudenberg are directed to non-remote phosphor devices. Remote phosphor devices contain a phosphor element that is physically separate from the light

Paper 26, IPR2024-01357 PO Resp., at 38.

emitter. EX2026, ¶ 120. Prof. Doolittle expressly stated that there would be multiple challenges to overcome in attempting to combine remote phosphor devices with non-remote phosphor devices because “by definition, a remote phosphor device is going to require more phosphor than a non-remote phosphor device.” EX2023 at 115:3-8. Petitioners have not explained how a POSITA would overcome this challenge in order to combine Basin-2007 and Van Woudenberg, which are directed to non-remote phosphor devices (*see, e.g.*, EX1005 at FIGs. 1-2 (showing phosphor coating applied directly upon the light emitting element); EX1020 at Abst. (describing a “phosphor coated” light emitting diode)) with Hussell, which is directed to a remote phosphor device (*see e.g.*, EX1011 at FIG. 1B (showing light emitting device physically separated from the wavelength conversion tube, the tube wall containing the phosphor element)).

Paper 26, IPR2024-01357 PO Resp., at 39.

There Is No Motivation to Whiten a Filament in a *Frosted* Bulb

Furthermore, embodiments of the “conventional incandescent lamp” style light emitting filaments described in Hussell (*see* EX1011, ¶ 52) available as of the filing date of the ’678 Patent included *frosted* bulbs. EX2026, ¶ 121. There would be no motivation to incorporate any TiO₂ encapsulant described in Basin-2007 in a frosted bulb embodiment because the “undesirable” yellow color of the phosphor conversion layer would not be visible, thus eliminating one of the claimed benefits of the ’678 Patent. *Id.* As for any unfrosted, Hussell-style bulbs, if Petitioners’ proposed combination were as obvious as Petitioners contend, bulb suppliers

would have been making and selling them years earlier to meet the long-felt need.

See Section IX.E.

Paper 26, IPR2024-01357 PO Resp., at 39-40.

Patentability: IPR2024-01357 Ground 3

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Krummacher, Shimizu, and Stokes

Paper 26, IPR2024-01357 PO Resp, at 41-45;
Paper 45, PO Surreply, at 5-8, 10-12.

Petitioners *Again* Rely Solely on Professor Doolittle for the Alleged Motivation to Combine

C. Ground 3: Petitioners Have Not Shown that a POSITA Would Have Been Motivated to Combine Krummacher in view of Shimizu and Stokes.

Petitioners have failed to establish that a POSITA would have been motivated to combine Krummacher, Shimizu, and Stokes for several reasons.

EX2026, ¶¶ 125-30. As with Grounds 1 and 2, Petitioners rely exclusively on the testimony of Prof. Doolittle, who again fails to address the very different lighting applications disclosed in these three separate references or explain why one of ordinary skill in the art would have selectively combined the cited teachings from these references. In addition, as discussed above in Section VIII, Patent Owner

Paper 26, IPR2024-01357 PO Resp., at 41.

Petitioners *Again* Fail to Address the Differences in Applications and Packaging

Krummacher, Shimizu, and Stokes are all different applications of LEDs. Krummacher discloses vertical flow chip configurations utilized in large area lighting units (see EX1007, ¶ 4; see also EX2026, ¶ 97), which is entirely different than the applications disclosed in Shimizu and Stokes. Shimizu discloses DIP and

Paper 26, IPR2024-01357 PO Resp., at 42.

lead-frame SMD LEDs in industrial applications such as LED displays, back light sources, traffic signals, railway signals, etc. (see EX1010 at 1:12-14; see also EX2026, ¶ 100), and Stokes also discloses DIP and lead-frame SMD LEDs involved in commercial applications such as automotive, display, and safety/emergency uses (see EX1008 at 1:19-20; see also EX2026, ¶ 102). These applications require different packaging approaches than Krummacher, and Petitioners have not demonstrated how a POSITA would easily incorporate the LEDs of Shimizu or Stokes into Krummacher beyond so-called “simple substitution.” EX2026, ¶ 128. For instance, Shimizu’s LED utilizes bond wires

Paper 26, IPR2024-01357 PO Resp., at 43.

Petitioners *Again* Fail to Address the Differences in Applications and Packaging—Even in Reply

4. Petitioners do not respond to Patent Owner's arguments regarding different LED packaging techniques

As explained in Patent Owner's Response and in Dr. Schubert's declaration, there are various forms of LED packaging, and the form has an effect on the light design and output. *See, e.g.*, Patent Owner Response to IPR2024-01357 (Paper 26) at 37-38; EX2026 at ¶¶ 42, 51-62, 109, 119, 128, 132. Petitioners do not address these differences in their Reply. It is Petitioners' burden to show (1) that one of skill in the art would have been motivated to combine this difference structures and (2) *how* one of skill in the art would have overcome these differences in order to arrive at the claimed invention. *See Tennent Co. v. Oxygenator Water Techs., Inc.*, IPR2021-00625, Paper 9 at 39 (P.T.A.B. Aug. 20, 2021) (criticizing petitioner for

Paper 45, PO Surreply, at 10.

Stokes Teaches Away

B. Stokes expressly teaches away from both the claimed invention and the other asserted prior art

Stokes is expressly critical of prior art in which the scattering material 46 is above, rather than below, the luminescent material 45. For example, Stokes acknowledges the Shimizu reference (EX1010, Pat. 6,069,440) as one method that discloses placing the light scattering material above the luminescent (phosphor) material, and Stokes expressly criticizes the resulting penumbra effect of the Shimizu approach. EX1008 at 2:23-64. Stokes similarly criticizes other prior art embodiments that placed the light scattering material above the luminescent material. *Id.* at 1:36 – 2:22; EX2039 at ¶ 17. Teaching away from the approach disclosed in Shimizu and these other prior art embodiments, which Stokes explains will all result in the undesirable penumbra effect, Stokes instead urges positioning the scattering material 46 between the radiation source 43 and the luminescent material 45, as discussed above and illustrated in Figure 5.

Paper 34, IPR2024-00260 PO Resp., at 27;
see also Paper 45, PO Surreply, at 8-10.

Patentability: IPR2024-01357 Ground 4

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Hussell, Van Woudenberg, and Krummacher

Paper 26, IPR2024-01357 PO Resp, at 45-47;
Paper 45, PO Surreply, at 5-8, 10-12.

Petitioners *Yet Again* Rely Solely on Professor Doolittle for the Alleged Motivation to Combine

D. Ground 4: Petitioners Have Not Shown that a POSITA Would Have Been Motivated to Combine Hussell, Van Woudenberg, and Krummacher.

Petitioners have failed to establish that a POSITA would have been motivated to combine Hussell, Van Woudenberg, and Krummacher for several reasons. EX2026, ¶¶ 131-34. As with Grounds 1-3, Petitioners rely exclusively on the testimony of Prof. Doolittle, who again fails to address the very different lighting applications disclosed in these three separate references or explain why one of ordinary skill in the art would have selectively combined the cited teachings from these references. In addition, as discussed above in Section VIII, Patent

Paper 26, IPR2024-01357 PO Resp., at 45.

Petitioners *Yet Again* Fail to Address the Differences in Applications and Packaging

Hussell, Krummacher, and Van Woudenberg are all different applications of LEDs. Hussell involves conventional incandescent replacement applications (see EX1011, ¶ 3), Krummacher depicts vertical chip configurations utilized in large area lighting units (see EX1007, ¶ 4; see also EX2026, ¶ 97), and Van Woudenberg involves “auxiliary lights in mobile phones or down-light units” using DIP and SMD LEDs (see EX1020 at Abstract; see also EX2026, ¶ 95). Petitioners offer nothing to meaningfully address how a POSITA would accommodate these differences to apply Krummacher’s light-scattering translucent layer in a vertical chip configuration to Hussell’s incandescent replacement application or Van Woudenberg’s auxiliary lights in DIP and SMD LEDs beyond generic “laminat[ing] or glu[ing].” Pet. 78 (quoting EX1007, ¶¶ 42-43). A POSITA would not find the packaging requirements for each structure and application able to be combined with a reasonable expectation of success. EX2026, ¶ 132.

Paper 26, IPR2024-01357 PO Resp., at 46.

Petitioners *Yet Again* Fail to Address the Differences in Applications and Packaging—Even in Reply

4. Petitioners do not respond to Patent Owner's arguments regarding different LED packaging techniques

As explained in Patent Owner's Response and in Dr. Schubert's declaration, there are various forms of LED packaging, and the form has an effect on the light design and output. *See, e.g.*, Patent Owner Response to IPR2024-01357 (Paper 26) at 37-38; EX2026 at ¶¶ 42, 51-62, 109, 119, 128, 132. Petitioners do not address these differences in their Reply. It is Petitioners' burden to show (1) that one of skill in the art would have been motivated to combine this difference structures and (2) *how* one of skill in the art would have overcome these differences in order to arrive at the claimed invention. *See Tennent Co. v. Oxygenator Water Techs., Inc.*, IPR2021-00625, Paper 9 at 39 (P.T.A.B. Aug. 20, 2021) (criticizing petitioner for

Paper 45, PO Surreply, at 10.

Patentability: IPR2025-00260 Ground 1

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Basin-2007 and Basin-2005

Paper 34, IPR2024-00260 PO Resp, at 34-40;
Paper 45, PO Surreply, at 5-8, 10-12.

Ground 1 of IPR2025-000260 Fails for the Same Reasons as Ground 1 of IPR2024-01357

- Petitioners Rely Solely on Professor Doolittle for the Alleged Motivation to Combine
- Petitioners Acknowledge That Basin-2007 Did Not Teach Blue Light With Wavelength $> 440\text{nm}$
- Petitioners Fail to Address the Different Applications of Basin-2007 and Basin-2005
- Professor Doolittle Provided *No Analysis* of the Differences in LED Applications and Packaging
- Recognizing the Lack of Motivation to Combine, Petitioners Improperly Tried to Add New Grounds

Paper 26, IPR2024-01357 PO Response, at 30-36;
Paper 34, IPR2025-00260 PO Response, at 34-40;
Paper 45, PO Surreply, at 2-8, 10-11;
see *also*, *supra*, slides 18-22.

Patentability: IPR2025-00260 Grounds 2 and 3

Petitioners Have Not Shown That a POSITA Would Have Been Motivated to Combine Stokes With Any Other Asserted Art

Paper 34, IPR2024-00260 PO Resp, at 23-33, 40-44;
Paper 45, PO Surreply, at 5-12.

Stokes Teaches Away

A. Combining Stokes with Basin-2007 or Krummacher would undermine the very reason Petitioners cite for combining them

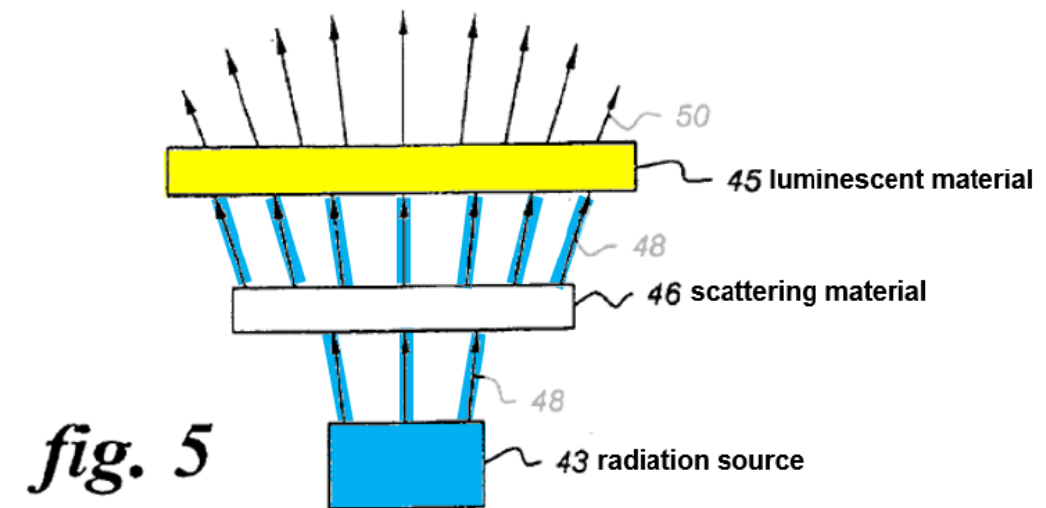
“An inference of nonobviousness is especially strong where the prior art’s teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements.” *Deputy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1326 (Fed. Cir. 2009). That is precisely the case here. Petitioners’ reliance on Stokes would violate the purpose of Stokes, or the requirements of claims 11-14, or both. The Petition fails entirely to explain how Stokes could be combined with Basin-2007 or Krummacher to arrive at the invention of claims 11-14. The reason is that no such combination is possible.

Paper 34, IPR2024-00260 PO Resp., at 24;
see also Paper 45, PO Surreply, at 8-10.

Stokes Teaches Away

Stokes describes a lamp containing a radiation source (*e.g.*, a blue LED chip), a luminescent material (*e.g.*, a phosphor) and—notably different from both the '678 Patent and the other asserted prior art—a radiation scattering material located *between* the radiation source and the luminescent material, as illustrated in Figure 5.

Paper 34, IPR2024-00260 PO Resp., at 24-27;
see *also* Paper 45, PO Surreply, at 8-10.



EX1008 at Abst., FIG. 5; EX2039 at ¶ 16; see EX2039 at ¶ 13.

Stokes Teaches Away

Therefore, one purpose of the scattering layer between the radiation source, such as the LED or a laser diode, and the luminescent material, such as a phosphor, is to make the blue light source appear more similar to the yellow light source. Thus, the blue light source effectively loses the memory of the LED or laser diode chip geometry, and the resulting collimation, by virtue of having been scattered by the scattering layer. If the radiation source is a higher intensity

EX1008 at 4:3-10;
Paper 34, IPR2024-00260 PO Resp., at 27-28.

scattering layer. If the radiation source is a higher intensity laser diode, then the scattering layer serves the additional purpose of lowering the intensity of the radiation incident on the phosphor, so as not to allow the intense, highly collimated and coherent laser radiation to damage the phosphor layer.

EX1008 at 4:10-15;
Paper 34, IPR2024-00260 PO Resp., at 28.

preferably 5–10 microns. By placing material **46** between the phosphor **45** and the LED **43**, the phosphor **45** will remain cooler than if the phosphor **45** was in direct contact with the heat emitting LED **43**. This configuration is advantageous because it reduces or eliminates the reversible thermal quantum efficiency degradation of the phosphor **45** during the operation of the lamp **41**.

EX1008 at 6:13-19;
Paper 34, IPR2024-00260 PO Resp., at 28.

Stokes Teaches Away

B. Stokes expressly teaches away from both the claimed invention and the other asserted prior art

Stokes is expressly critical of prior art in which the scattering material 46 is above, rather than below, the luminescent material 45. For example, Stokes acknowledges the Shimizu reference (EX1010, Pat. 6,069,440) as one method that discloses placing the light scattering material above the luminescent (phosphor) material, and Stokes expressly criticizes the resulting penumbra effect of the Shimizu approach. EX1008 at 2:23-64. Stokes similarly criticizes other prior art embodiments that placed the light scattering material above the luminescent material. *Id.* at 1:36 – 2:22; EX2039 at ¶ 17. Teaching away from the approach disclosed in Shimizu and these other prior art embodiments, which Stokes explains will all result in the undesirable penumbra effect, Stokes instead urges positioning the scattering material 46 between the radiation source 43 and the luminescent material 45, as discussed above and illustrated in Figure 5.

Paper 34, IPR2024-00260 PO Resp., at 27-28;
see also Paper 45, PO Surreply, at 8-10.

Stokes Teaches Away

C. The Petition fails to explain how Stokes could be combined with Basin-2007 or Krummacher to provide the features of Claims 11-14

One of skill in the art could not have combined Stokes with any of the other cited references in order to arrive at the '678 Patent claims because Stokes teaches positioning the phosphor on the *exterior* of the filament. See EX1008 at FIG. 5; EX2039 at ¶¶ 16, 19; EX2038 at 43:3-5. In other words, an observer looking at the Stokes filament would see the phosphor layer on the outside—which is exactly what the '678 Patent sought to avoid. EX2039 at ¶ 19; EX2038 at 41:9-12, 43:3-5.

Paper 34, IPR2024-00260 PO Resp., at 24;
see also Paper 45, PO Surreply, at 8-10.

Stokes Teaches Away

Nor have Petitioners explained *how* one of skill in the art allegedly would have modified the primary references in light of Stokes to arrive at the invention recited in claims 11-14. For example, claim 11 adds the limitation that “the light scattering material has an average particle size that is selected such that the light scattering material will scatter the excitation light relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material.” But, as shown in Stokes Figure 5, the light scattering material 46 in Stokes cannot effectively scatter any excitation light because it is *between* the radiation source 43 and the luminescent material 45.

EX1008 at FIG. 5.

Paper 34, IPR2024-00260 PO Resp., at 30;
see also Paper 45, PO Surreply, at 8-10.

Stokes Teaches Away

Worse yet, Petitioners' *only* stated motivation to combine Krummacher and Stokes is that "a POSA would have been motivated to apply [Stokes] to [Basin-2007 / Krummacher], because it would increase the conversion of blue light to yellow light and improve the uniformity of the light source." IPR2025-00260 Pet. at 39, 60. But as explained above, this alleged benefit of Stokes would not be available to the device in Basin-2007 or Krummacher because it would require

reversing the core teaching in Stokes and instead adopting the approach that Stokes expressly criticized. The Federal Circuit has made it clear that "[a]n inference of nonobviousness is especially strong where the prior art's teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements." *Depuy Spine*, 567 F.3d at 1326.

Accordingly, Petitioners have failed to meet their burden of proving that claims 11-14 are unpatentable.

Paper 34, IPR2024-00260 PO Resp., at 32-33;
see also Paper 45, PO Surreply, at 8-10.

Contingent Motion to Amend

Substitute Claims 30-49

Paper 46, Revised Motion to Amend, at 4-20;
Paper 55, Reply in Support of Revised Motion to Amend, at 1-12.

Contingent Substitute for Original Claim 1

30. A wavelength conversion component for a light emitting device comprising:

a wavelength conversion layer comprising particles of at least one photoluminescence material; and

a light diffusing layer comprising particles of a light scattering material, wherein the light diffusing layer improves an off-state white appearance of the wavelength conversion component;

wherein the light diffusing layer is configured such that a portion of excitation light generated by the light emitting device is directed back at the wavelength conversion layer;

wherein the wavelength conversion component is configured such that in operation a portion of excitation light comprising blue light having a wavelength of ~~greater than or equal to 440 nm~~ between 450 nm and 470 nm generated by the light emitting device is emitted through the wavelength conversion component to contribute to a final visible emission product;

wherein the portion of excitation light generated by the light emitting device and directed back at the wavelength conversion layer reduces the wavelength conversion layer material necessary for a given color emission product.

Paper 46, Revised Motion to Amend, at A1.

Contingent Substitute for Original Claim 2

31. The component of claim [[1]]30, wherein the wavelength conversion layer and the light diffusing layer are in direct contact with each other, and
wherein the wavelength conversion layer material necessary for a given color emission product is reduced by between 20% and 40%.

Paper 46, Revised Motion to Amend, at A2.

Contingent Substitute for Original Claim 19

40. A light emitting device, comprising:
at least one solid-state light emitter operable to generate excitation light; and
a wavelength conversion component comprising:
a wavelength conversion layer excitable by the excitation light, wherein the wavelength conversion layer comprises particles of at least one photoluminescence material; and
a light diffusing layer comprising particles of a light scattering material,
wherein the light diffusing layer improves an OFF state white appearance of the wavelength conversion component;
wherein the wavelength conversion component is configured such that in operation a portion of light comprising blue light having a wavelength of ~~greater than or equal to 440 nm~~ between 450 nm and 470 nm generated by the at least one solid-state light emitter is emitted through the wavelength conversion component to contribute to a final visible emission product;
wherein the light scattering material scatters excitation light from the one or more solid-state light emitters relatively more than the light

scattering material scatters light generated by the at least one photoluminescence material.

Paper 46, Revised Motion to Amend, at A4-A5.

Contingent Substitute for Original Claim 29

45. A light bulb comprising:

a connector base configured to be inserted in a socket to form an electrical connection for the light bulb;

a body comprising one or more solid-state light emitters;

a wavelength conversion component having a three dimensional shape that is configured to enclose the one or more solid-state light emitters and to in part at least define a light mixing chamber,

wherein the wavelength conversion component comprises a wavelength conversion layer comprising particles of at least one photoluminescence material and a light diffusing layer comprising particles of a light scattering material,

wherein the light diffusing layer improves an off-state white appearance of the wavelength conversion component;

wherein the wavelength conversion component is configured such that in operation a portion of light comprising blue light having a wavelength of ~~greater than or equal to 440 nm~~ between 450 nm and 470 nm generated by the one or more solid-state light emitters is emitted through the wavelength conversion component to contribute to a final visible emission product;

wherein the light scattering material scatters excitation light from the one or more solid-state light emitters relatively more than the light scattering material scatters light generated by the at least one photoluminescence material.

Paper 46, Revised Motion to Amend, at A6.

The Original Specification Supports Wavelengths of “450 nm to 470 nm”

A. The original specification expressly supports the 450 nm to 470 nm feature recited in limitations 30[e], 40[b][4], and 45[f]

Claim 1, as originally issued, recites “the wavelength conversion component is configured such that in operation a portion of excitation light comprising blue light having a wavelength of greater than or equal to 440 nm generated by the light emitting device is emitted through the wavelength conversion component to contribute to a final visible emission product.”¹ See EX1001 at 26:18-24. This limitation finds support in the originally filed application, for example, at ¶ 0047, which describes LEDs that generate blue light “in a wavelength range of 400 nm to 480 nm (typically 450 nm to 470 nm).” EX1004 at 53, ¶ 0047; see Paper 42 at 23-

Paper 55, PO Reply in Support of Revised Motion to Amend, at 3-4.

The Reduction in Wavelength Conversion Material Is Not Obvious

B. The reduction in wavelength conversion material recited in limitation 30[f] is not obvious

As Patent Owner explained in its Revised Motion (Paper 46 at 16-18), Petitioners' arguments rest on hindsight bias and conclusory testimony, which should be provided no weight. Petitioners do not even address these arguments in their renewed opposition. See Paper 49 at 11-13.

Citing no evidence in support, Petitioners baldly state that the reduction in wavelength conversion material amounts to "the natural result of obvious structure." Paper 49 at 12. Petitioners tout Professor Doolittle's testimony (Paper 49 at 13), but close inspection shows that the cited testimony is conclusory at best. See EX1065, ¶¶ 11-15. Professor Doolittle cites to no reference materials and offers no explanation of the reasoning behind his conclusion that the claimed reduction in wavelength conversion material was allegedly known to a POSITA.

To the extent Professor Doolittle offers any support at all, it comes only from the '678 patent itself. See EX1065, ¶ 15 (citing EX1001 specification). This is the very definition of hindsight bias. See *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) ("A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning." (citing *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 36 (1966) (warning against a "temptation to read into the prior art the teachings of the invention in issue" and instructing courts to "guard against slipping into use of hindsight")))). Patent Owner respectfully submits that Petitioners have not met their burden, and the Board should reject Petitioners' arguments with respect to amended claim 30. See *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, -01130, Paper 15 at 4 (P.T.A.B. Feb. 25, 2019).

Paper 55, PO Reply in Support of Revised Motion to Amend, at 5-6.

The Reduction of Between 20% and 40% Is Fully Supported, Not Indefinite, and Not Obvious

C. The reduction of between 20% to 40% recited in claim 31 is fully supported, not indefinite, and not obvious

The proposed amendment requiring a 20% to 40% reduction in wavelength conversion material is fully supported by the original specification. *See* Paper 46 at 7 (identifying support for claim element 31[b]). Petitioners themselves cite to multiple examples of support in the specification. *See* Paper 49 at 5-6. For

instance, Petitioners acknowledge that “[t]he specification discloses reduction of ‘up to 40%’” and “experimental reductions of approximately 25% and 33%.” *Id.* (citing EX1001). The claimed range of 20% to 40% falls within the broader range of “up to 40%” disclosed in the specification and captures both of the specifically-described examples that Petitioners cite (25% and 33%). Again, Petitioners overlook both the Board’s Preliminary Guidance and the Federal Circuit’s precedent that *in haec numera* recitation is not necessary. Paper 42 at 24; *see, e.g., Rai Strategic Holdings, Inc. v. Philip Morris Prods. S.A.*, 92 F.4th 1085, 1088 (Fed. Cir. 2024) (finding sufficient written description support where “[t]he claims at

Paper 55, PO Reply in Support of Revised Motion to Amend, at 6-8.

The Reduction of Between 20% and 40% Is Fully Supported, Not Indefinite, and Not Obvious

D. The relative scattering feature recited in limitation 40[b][5] and 45[g] is not obvious over Stokes²

As Patent Owner explained in its Revised Contingent Motion to Amend (Paper 46 at 18-20), Petitioners' obviousness arguments fail because Stokes, upon which Petitioners rely for every ground, actively teaches away from any combination with Basin-2007 and/or Krummacher. Petitioners now assert that "Stokes does not teach away from the particle-size principle" (Paper 49 at 16), but this conflates two different issues: (1) whether one of skill in the art would have been motivated to combine Stokes with Basin-2007 or Krummacher; and

(2) whether Stokes actually teaches the particle-size principle. Unless Petitioners can demonstrate an affirmative answer to the first question, the second question does not matter. Petitioners have failed to demonstrate that affirmative answer to the first question—because Stokes expressly teaches away from any combination with Basin-2007 or Krummacher.

Paper 55, PO Reply in Support of Revised Motion to Amend, at 9-12.