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Paper 11
Date: October 6, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAVANT TECHNOLOGIES LLC d/b/a GE LIGHTING,
ELONG INTERNATIONAL USA INC., and
XIAMEN LONGSTAR LIGHTING CO. LTD.,
Petitioners,

v.

FEIT ELECTRIC COMPANY, INC.,
Patent Owner.

IPR2025-00698
Patent 8,614,539 B2

Before THOMAS L. GIANNETTI, BENJAMIN D. M. WOOD, and KEVIN W. CHERRY, *Administrative Patent Judges*.

CHERRY, *Administrative Patent Judge*.

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

I. INTRODUCTION

Savant Technologies LLC d/b/a GE Lighting, Elong International USA Inc., and Xiamen Longstar Lighting Co. Ltd. ("Petitioner") filed a petition to institute *inter partes* review of claims 1–11, 18–20, 23–25, and 28 of U.S. Patent No. 8,614,539 B2 (Ex. 1101, "the '539 patent"). Paper 5 ("Pet."). Feit Electric Company, Inc. ("Patent Owner") filed a Preliminary Response. Paper 10 ("Prelim. Resp.").

We have authority under 35 U.S.C. § 314 to determine whether to institute an *inter partes* review. The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." The Supreme Court has held that the Board, in a decision to institute under 35 U.S.C. § 314(b), may not institute review on less than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 584 U.S. 357, 371 (2018). Moreover, in accordance with our rules, "[w]hen instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim." 37 C.F.R. § 42.108(a) (2020); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require "a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition").

Applying those standards, and upon considering the Petition, the Preliminary Response, and the evidence of record, we determine the information presented demonstrates a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the

challenged claims of the ’539 patent. Accordingly, we institute an *inter partes* review.

II. BACKGROUND

A. Related Matters

The parties identify the following district-court proceeding as a related matter involving the ’539 patent: *Feit Electric Co., Inc. v. Savant Technologies LLC d/b/a GE Lighting*, No. 1:24-cv-473 (N.D. Ohio). Pet. 80; Paper 8, 1 (Patent Owner’s Mandatory Notices). The parties also identify the following petitions for *inter partes* review involving U.S. Patent No. 8,604,678 B2 (“the ’678 patent”), which is related to the ’539 patent: IPR2024-01357; IPR2025-00258; and IPR2025-00260. Pet. 80–81; Paper 8, 1–2. Patent Owner also identifies the following proceedings involving the ’678 patent: *Feit Electric Co., Inc. v. Savant Technologies LLC d/b/a GE Lighting*, No. 1:24-cv-473 (N.D. Ohio); *Feit Electric Co., Inc. v. LEDVANCE, LLC*, No. 5:24-cv-31 (E.D. Ky.); and *Feit Electric Co., Inc. v. Elong International USA Inc.*, No. 3:24-cv-1089 (N.D. Tex.). Paper 8, 1.

B. Real Parties in Interest

Petitioner identifies Savant Technologies LLC d/b/a GE Lighting, Elong International USA Inc., Xiamen Longstar Lighting Co. Ltd., and Seoul Semiconductor Co. Ltd. as real parties in interest. Pet. 80. Petitioner further states that “LEDVANCE LLC is not a Real Party-in-Interest, but it does have a business relationship with Seoul Semiconductor Co. Ltd. and is identified here for Board assessment of internal conflicts of interest.” *Id.*

Patent Owner identifies Feit Electric Company, Inc. as its real party in interest. Paper 8, 1.

C. The '539 Patent

The '539 patent is titled "Wavelength Conversion Component with Scattering Particles." Ex. 1101, code (54).

The '539 patent relates to light-emitting diode (LED) devices that use photoluminescent materials to generate a desired color of light—generally white. *Id.* at 1:24–26. The background section explains that traditional LED devices work by using a diode that emits blue or ultraviolet (UV) light and photoluminescent materials, e.g., phosphors, that absorb the blue/UV light and re-emit light of a different color. *Id.* at 1:30–42, 46–50. The combination of the unabsorbed blue/UV light from the diode and the light emitted by the phosphors appears nearly white to the human eye. *Id.* at 1:42–46.

The problem with these systems, the '539 patent explains, is that the devices do not look white when the diode is in the OFF state. *Id.* at 1:64–2:10. This is because the phosphors continue converting the ambient light to a different wavelength even as the diode is not emitting any blue light. *Id.* The result is that, in the OFF state, traditional LED devices do not look white—they have a yellowish, yellow-orange, or orange-color appearance—which some potential consumers may find is "off-putting or undesirable." *Id.* at 2:6–16. The patent lists several other problems with traditional LED devices as well: the color of the emitted light changes depending on the emission angle and the phosphors being used are relatively costly. *Id.* at 2:17–41.

The '539 patent proposes to solve these problems in light emitting devices by modifying the wavelength-conversion component—the component that includes the luminescent material—to include a "a light diffusing layer comprising particles of a light diffractive material" such as

TiO_2. *Id.* at 2:55–3:14. The particles in the light diffusing layer are designed to scatter external blue light, "decreasing the probability of externally originated photons interacting with a phosphor material." *Id.* at 11:40–47. The patent asserts that, if properly assembled, this arrangement leads to various improvements in LED devices: the devices have a "white color appearance" even in their OFF state; there is greater "color uniformity of emitted light from an LED device for emission angles over a ±60° range from the emission axis"; and there is a "substantial[] reduc[tion in] the quantity of phosphor material required to generate a selected color of emitted light" by as much as 40%. *Id.* at 3:15–32.

D. The Challenged Claims

Petitioner challenges claims 1–11, 18–20, 23–25, and 28 of the '539 patent. Pet. 1. Of the challenged claims, claims 1, 18, and 28 are independent and are reproduced below, with Petitioner's identifiers for the claim limitations, as illustrative of the subject matter recited in the challenged claims.

1[pre] A wavelength conversion component for a light emitting device comprising:

[a] at least one photoluminescence material; and

[b] a light scattering material, **[c]** wherein the light scattering material has an average particle size that is selected such that the light scattering material will scatter excitation light from a radiation source relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material,

[d] wherein the wavelength conversion component is configured such that in operation a portion of the excitation light comprising blue light having a wavelength of greater than or equal to 440

nm is emitted through the wavelength conversion component to contribute to a final visible emission product;

[e] wherein the light scattering material scatters the blue light at least twice as much as light generated by the at least one photoluminescence material.

Ex. 1101, 26:14–31.

E. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Declaration of William A. Doolittle, Ph.D.	1102
Krummacher, US 2008/0079015 A1 (published Apr. 3, 2008, filed Sep. 18, 2007) ("Krummacher")	1107
Stokes et al., U.S. Patent No. 6,791,259 B1 (issued Sep. 14, 2004, filed Aug. 22, 2000) ("Stokes")	1108
Shimizu et al., U.S. Patent No. 6,069,440 (issued May 30, 2000, filed Apr. 28, 1999) ("Shimizu")	1110
Hussell et al., US 2010/0124243 A1 (published May 20, 2010, filed Nov. 18, 2008) ("Hussell")	1111
Van Woudenberg et al., WO 2008/044171 A2 (published Apr. 17, 2008, filed Oct. 4, 2007) ("Van Woudenberg")	1120

Patent Owner supports its Preliminary Response with the Declaration of E. Fred Schubert, Ph.D. Ex. 2001.

F. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–11, 18–20, 23–25	103(a)[1]	Krummacher, Stokes, Shimizu
18, 28	103(a)	Hussell, Krummacher, Stokes, Van Woudenberg

Pet. 19.

III. PATENTABILITY ANALYSIS

Petitioner contends that claims 1–11, 18–20, 23–25 of the '539 patent are unpatentable under 35 U.S.C. § 103(a) over various combinations of Krummacher, Stokes, Shimizu, Hussell, and Van Woudenberg. Pet. 19.

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective

[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103. The '539 patent issued from Application Serial No. 13/273,215 which was filed October 13, 2011, before the effective date of the applicable AIA amendments. Ex. 1101, code (22). Thus, we refer to the pre-AIA version of 35 U.S.C. § 103.

evidence of nonobviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")).

We organize our patentability analysis into four sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. Third, we provide an overview of the asserted references. And fourth, taking account of the information presented, we consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

A. Level of Ordinary Skill in the Art

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art. In assessing the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir.

[2] Patent Owner does not present evidence of secondary considerations in its Preliminary Response. Therefore, secondary considerations do not constitute part of our analysis herein.

1986)). "[O]ne or more factors may predominate." *Id.*

Relying on the declaration testimony of Dr. Doolittle, Petitioner contends that an ordinarily skilled artisan for the '539 patent "would have had an undergraduate degree (i.e., B.S., B.S.E. or the equivalent) in electrical engineering, materials science, physics, or a similar discipline" and "would also have one to two years of experience in the field of LED packaging design." Pet. 6. Petitioner additionally contends that "[m]ore education could substitute for experience, and vice versa." *Id.* Petitioner further contends that "[t]his person would have been capable of understanding and applying the teachings of the '539 patent and the prior-art references discussed herein," and "[m]oreover, the prior art reflects the level of skill at the time of the claimed invention." *Id.* (citing *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); Ex. 1102 ¶¶ 38–42).

Patent Owner states that "solely for the purposes of this proceeding, Patent Owner and its technical expert employ the same level of skill in the art as Petitioners." Prelim. Resp. 22.

Based on this record, we adopt Petitioner's articulation of the level of ordinary skill in the art, which is consistent with the '539 patent and the asserted prior art, and we apply it in our obviousness analysisbelow. *See Okajima*, 261 F.3d at 1355 (the prior art, itself, can reflect appropriate level of ordinary skill in art).

B. Claim Construction

In interpreting the claims of the '539 patent, 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)." *See* 37 C.F.R. § 42.100(b) (2020). The claim construction standard includes construing claims in

accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner contends that "no construction should be necessary to institute this petition." Pet. 20. Patent Owner "requests that the Board adopt the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art." Prelim. Resp. 22.

Having considered the record, we determine that, at this stage, no express claim construction is necessary for any claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (holding that only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))). We note, however, there may be some claim terms below whose constructions that the parties may wish to address during trial.

C. The Prior Art

Before turning to Petitioner's asserted grounds of unpatentability, we provide brief summaries of the asserted references.

1. Krummacher (Ex. 1107)

Krummacher is titled "Optoelectronic Component Having a Luminescence Conversion Layer." Ex. 1107, code (54). Krummacher, too, is directed to the OFF-state problem mentioned above. *See* Ex. 1107 ¶¶ 3, 4. Krummacher explains that it was known to combine a component that contains an LED that generates blue or UV light with a luminescence conversion layer to convert some of the light to yellow, "such that the blue

or ultraviolet radiation emitted by the active region is superimposed on the fraction converted to the complementary color to yield white light." *Id.* ¶¶ 3, 4, 33.

The problem with this approach, Krummacher explains, is that the luminescence conversion layer emits yellow light even when the light-emitting component is in its OFF state, so the surface looks yellow, "which is often found unattractive by observers." *Id.* ¶ 4. Krummacher suggests solving this problem by including scattering particles, "[p]articularly . . . TiO_2 or Al_2O_3." *Id.* ¶ 39; *see id.* code (57); ¶ 6. Krummacher's Figures 1 and 2, reproduced below, are particularly relevant to this case.

FIG 1

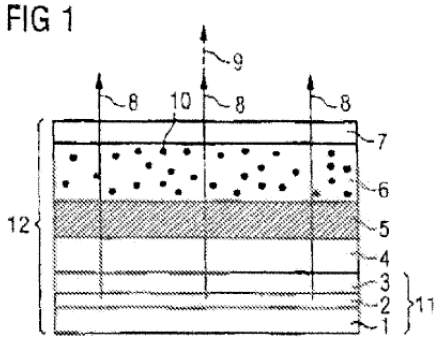
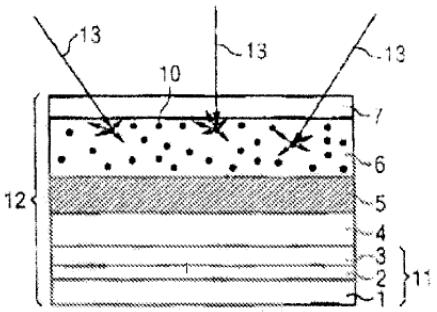


FIG 2



Figures 1 and 2 depict "a schematic graphic representation of a cross section through an optoelectronic component" in the ON and OFF state, respectively. *Id.* ¶¶ 27, 28. In these figures, reference number "5" depicts the "luminescence conversion layer," and reference number "6" depicts the "light-scattering translucent layer." *Id.* ¶¶ 37–39. Krummacher explains that "the light-scattering translucent layer 6 contains light-scattering particles 10, which, as illustrated in FIG. 2, serve to scatter environmental light 13 striking the optoelectronic component from the outside. . . . Particularly suitable are particles of TiO_2 or $Al2O_3$." *Id.* ¶ 39. According to

Krummacher, "the distribution, size and material of the light-scattering particles 10 in light-scattering translucent layer 6 are selected such that the surface of light scattering translucent layer 6 appears white," and "the luminescence conversion layer 5 is advantageously prevented from exhibiting a yellowish hue, in the off state of the optoelectronic component depicted in FIG. 2." *Id.* ¶ 41.

2. Stokes (Ex. 1108)

Stokes is entitled "Solid State Illumination System Containing a Light Emitting Diode, a Light Scattering Material and a Luminescent Material." Ex. 1108, code (54). Stokes "relates generally to a white light illumination system, and specifically to a solid state lamp containing a semiconductor light emitting diode ('LED') or laser diode, a light scattering material, and a luminescent phosphor or dye material." Ex. 1008, 1:11–15.

Stokes explains that "LEDs are used in a number of commercial applications such as automotive, display, safety/emergency and directed area lighting," and that "[r]ecently, a white light emitting lamp was developed which includes a blue light emitting diode and a yellow emitting phosphor." *Id.* at 1:18–22. According to Stokes, "[t]he blue light emitted by the LED excites the phosphor, causing it to emit yellow light," and "[t]he blue light emitted by the LED is transmitted through the phosphor and is mixed with the yellow light emitted by the phosphor." *Id.* at 1:31–35. Stokes explains that "[t]he viewer perceives the mixture of blue and yellow light as white light." *Id.* at 1:35–38. However, according to Stokes, "these white LED lamps suffer from the undesirable halo effect and the penumbra effect." *Id.* at 1:36–38.

Stokes explains that the halo effect occurs due to the separation of blue and yellow light as the LED emits blue light in a directional, anisotropic fashion and the phosphor emits yellow light isotropically (i.e., in all directions). *Id.* at 1:39–42. Therefore, according to Stokes, when the light output is viewed straight on, it appears bluish white, but when the light output is viewed at an angle, the light appears yellowish. *Id.* at 1:42–47. Stokes further explains that when the light output is directed onto a flat surface, it appears as a yellowish halo surrounding a bluish area. *Id.* at 1:48–50. Stokes indicates that "[t]he penumbra effect is similar to the halo effect, except that the halo effect is a color separation effect, while the penumbra effect is a non-uniform intensity effect." *Id.* at 1:51–53. Stokes explains that "[t]he penumbra effect causes the white LED lamp emission to appear brighter at the center than at the edges." *Id.* at 1:53–55.

Stokes teaches "in order to obtain a significant decrease in the halo and/or penumbra effects, [a] radiation scattering material is placed between the radiation source, such as an LED or a laser diode, and the luminescent material, such as a phosphor or a dye." *Id.* at 3:57–61. According to Stokes, "[w]hen the radiation scattering material is placed between the radiation source and the luminescent material, the radiation source radiation being scattered isotropically, is made substantially uniform and diffuse prior to being incident on the phosphor," and "the lamp emits white light with high far field color and intensity uniformity." *Id.* at 3:63–4:2.

Stokes discloses, in one preferred embodiment, that "the radiation scattering particles have a size such that the particles preferentially scatter blue or UV LED light as compared to yellow, green, red or white light from

the luminescent material." *Id.* at 7:1–4. Figure 6 of Stokes is reproduced below.

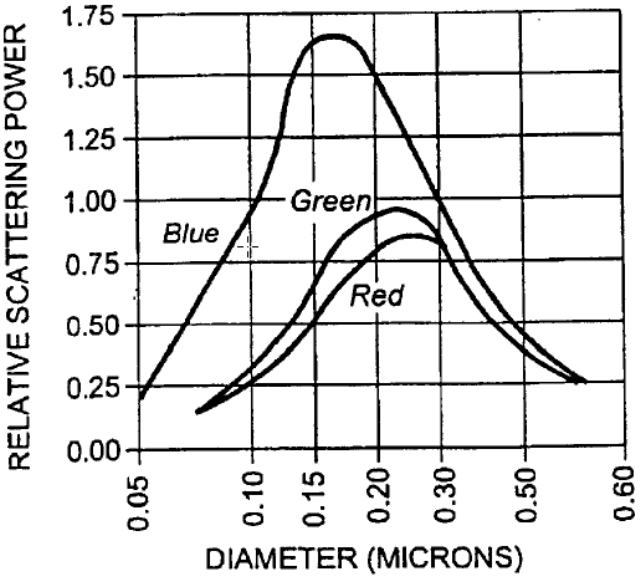


Figure 6 of Stokes "illustrates the relationship between the particle diameter and the wavelength of the Scattered light for Ti-Pure(R) rutile TiO_2 particles made by DuPont." *Id.* at 7:7–9. Stokes explains that

> As illustrated in FIG. 6, the relative scattering power of 100 to 200 nm TiO_2 particles is above 1 for blue incident radiation, while it is below 1 for green and red incident radiation. Therefore, as illustrated in FIG. 6, 100 to 200 nm particles have at least a 50% greater scattering power for blue radiation (i.e., Such as that emitted by a blue emitting LED) than green or red (or for that matter yellow) radiation (i.e., Such as that emitted by the phosphor or dye). This particle size range is advantageous because it enhances the scattering of the radiation source radiation while it decreases the amount of scattering of the luminescent material radiation.

Id. at 7:9–22.

3. Shimizu (Ex. 1110)

Shimizu is titled "Light Emitting Device Having a Nitride Compound Semiconductor and a Phosphor Containing a Garnet Fluorescent Material."

Ex. 1110, code (54). Shimizu discloses "a light emitting device (LED) comprising a phosphor, which converts the wavelength of light emitted by a light emitting component and emits light." *Id.* at 1:15–17.

Shimizu discloses a molding material that has the function to protect the light emitting component, a conductive wire, and a coating material which contains phosphor from external disturbance. *Id.* at 16:59–62. According to Shimizu, "it is preferable that the molding material . . . further contain a dispersant, which can unsharpen the directivity of light from the light emitting component . . ., resulting in increased angle of view." *Id.* at 16:62–66.

Shimizu explains that "adding the dispersant and/or a coloration agent in the molding material has the effects of masking the color of the fluorescent material." *Id.* at 17:25–28. According to Shimizu, "the fluorescent material absorbs blue component of extraneous light and emits light thereby to give such an appearance as though colored in yellow," but "the dispersant contained in the molding material gives milky white color to the molding material and the coloration agent renders a desired color." *Id.* at 17:29–34. Thus, Shimizu explains, "the color of the fluorescent material will not be recognized by the observer." *Id.* at 17:34–35.

4. Hussell (Ex. 1111)

Hussell is entitled "Semiconductor Light Emitting Apparatus Including Elongated Hollow Wavelength Conversion Tubes and Methods of Assembling Same." Ex. 1111, code (54).

Hussell discloses a "semiconductor light emitting apparatus includes an elongated hollow wavelength conversion tube that includes an elongated wavelength conversion tube wall having wave length conversion material,

such as phosphor, dispersed therein." *Id.* at code (57). Hussell explains that high efficiency white light production may be obtained by causing almost all of the light that is emitted by a semiconductor light emitting device to strike the elongated wavelength conversion tube wall 112 at an oblique angle. *Id.* ¶ 38.

Hussell indicates that various embodiments may be "regarded as providing a semiconductor light emitting filament that may be analogized to the filament of a conventional incandescent lamp or to a miniature fluorescent bulb." *Id.* ¶ 52. According to Hussell, a bulb and a screw-type base may be provided, so that the combination of the elongated hollow wavelength conversion tube and packaged semiconductor light emitting devices at opposite ends thereof provides a filament for a drop-in replacement for an incandescent bulb. *Id.*

5. Van Woudenberg (Ex. 1120)

Van Woudenberg is entitled "LED Based Luminaire and Lighting Device." Ex. 1120, code (54). Van Woudenberg relates to a lighting device comprising a phosphor coated light emitting diode ("pc-LED"). *Id.* at code (57), 1:9–10.

According to Van Woudenberg, "[t]he distinguished yellowish appearance of pc-LEDs and the luminaire in their functional off state is in a large number of applications a disturbing feature." *Id.* at 1:27–28.

Van Woudenberg discloses "a lighting device that still provides a very minute amount of light in the functional off state of the device," noting that "this amount of light is so small that the device in this functional off state can in almost all practical circumstances not be used for its intended purpose." *Id.* at 2:17–19. Van Woudenberg explains that

> [a]s a result of the residual current running through the pc-LED in the functional off state of the lighting device, the tiny amount of light produced by the pc-LED outshines the reflected ambient light—which due to the optical characteristics of the phosphor is filtered to become yellowish—from the pc-LED. Hence, the pc-LED will appear to have a neutral white color to the human eye.

Id. at 2:19–23.

D. Alleged Ground of Unpatentability Over Krummacher, Stokes, and Shimizu

Petitioner contends that claims 1–11, 18–20, and 23–25 of the '539 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Krummacher, Stokes, and Shimizu. Pet. 20–53. Patent Owner opposes. Prelim. Resp. 22–28.

1. Claim 1

a) Petitioner's Contentions

Petitioner argues that "Krummacher discloses every element of the independent claims except which particle sizes were known to preferentially scatter blue light and the specific wavelength of blue light emitted by the LED chip." Pet. 20. Petitioner asserts that "light defusing layers that preferentially scatter blue light and LED chips emitting blue light at greater than or equal to 440 nm were well known in the art as evidenced by Stokes and Shimizu (incorporated by reference in Stokes)." *Id.* at 20–21. In particular, Petitioner submits that Krummacher discloses "[a] wavelength conversion component for a light emitting device comprising," *id.* at 21–22 (citing Ex. 1107 ¶¶ 34, 38, Figs. 1, 2; Ex. 1102 ¶¶ 110–114); "at least one photoluminescence material," *id.* at 22–23 (citing Ex. 1107 ¶¶ 23, 36, 37, Figs. 1, 2; Ex. 1102 ¶¶ 95, 115–118); and "a light scattering material," *id.* at 24 (citing Ex. 1107 ¶¶ 38, 39; Ex. 1102 ¶¶ 119–121).

With respect to limitation 1[c]

> wherein the light scattering material has an average particle size that is selected such that the light scattering material will scatter excitation light from a radiation source relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material,

Petitioner notes that Stokes discloses certain sizes of particles preferentially scatter blue or UV LED light as compared to yellow, green, red, or white light. *Id.* at 25 (citing Ex. 1108, 7:1–4). Petitioner further notes that Figure 10 of the '539 patent and Figure 6 of Stokes are "essentially the same," and "show the relative scattering power of TiO_2 based on particle size for different colors of light." *Id.* (citing Ex. 1102 ¶¶ 122–123).

Petitioner then offers two theories for how the combination of Krummacher and Stokes teaches this limitation. Pet. 26–28. First, Petitioner argues that Krummacher discloses a light-scattering material with TiO_2 particles "preferably having a radius between 50 nm inclusive and 1000 nm inclusive." *Id.* at 26 (citing Ex. 1107 ¶ 39). Petitioner asserts that "[a]ccording to the DuPont model, TiO_2 particles of such a size generally scatter more blue light (e.g., excitation light) than red or green light (e.g., light emitted by the phosphor)." *Id.* (citing Ex. 1102 ¶ 124). Thus, Petitioner contends that Krummacher teaches this claim limitation through its disclosure of the selection of average size particles that preferentially scatter blue light. *Id.*

Second, Petitioner argues that "[t]o the extent that the claim language 'an average particle size that is selected such that [it preferentially scatters blue light]' requires an average particle size selected for that reason (rather than an average particle size that leads to that outcome), this claim element is rendered obvious by Stokes." *Id.* at 26–27 (citing Ex. 1102 ¶ 125)

(second alteration in original). Petitioner notes that Stokes discloses selection of particles of a size that preferentially scatters blue light. *Id.* at 27 (citing Ex. 1108, 7:1–4). Petitioner asserts that a person of ordinary skill in the art "would have had a reason to use such a basis for selecting average particle size as taught by Stokes." *Id.* (citing Ex. 1102 ¶¶ 126–128; Ex. 1108, 7:17–26). Petitioner contends that a person of ordinary skill in the art "would have been motivated to apply this principle to Krummacher, because it would increase the conversion of blue light to yellow light and improve the uniformity of the light source." *Id.* (citing Ex. 1102 ¶ 128). Petitioner argues that "[c]onversion of blue light to yellow light is improved by maximizing the scattering of blue light," and "[u]niformity is improved by preferentially scattering the concentrated light from the blue-light LED chip instead of the diffuse light emitted by the phosphor." *Id.* at 27–28. Thus, a person of ordinary skill would have been motivated to combine the references. Petitioner also submits that a person of ordinary skill would have had a reasonable expectation of success in applying Stokes's teachings regarding particle size to Krummacher. *Id.* at 28 (citing Ex. 1102 ¶ 129).

> With respect to claim limitation 1[d]—
>
> > wherein the wavelength conversion component is configured such that in operation a portion of the excitation light comprising blue light having a wavelength of greater than or equal to 440 nm is emitted through the wavelength conversion component to contribute to a final visible emission product,

Petitioner asserts that the combination of Krummacher, Stokes, and Shimizu teaches or suggests this limitation, and that a person of ordinary skill in the art would have been motivated to combine the references with a reasonable expectation of success. *See id.* at 28–31 (citing Ex. 1102 ¶¶ 131–136; Ex. 1110, 23:43, 27:4–5, 28:55, 25:24–25; 29:45; Ex. 1108, 4:37–40; Ex.

1107 ¶ 3). In particular, Petitioner notes that Stokes and Shimizu provide details of the conventional white light source used in Krummacher. *Id.* at 31.

Finally, Petitioner argues that the combination of Krummacher and Stokes teaches limitation 1[e]—"wherein the light scattering material scatters the blue light at least twice as much as light generated by the at least one photoluminescence material." Pet. 32–37 (citing Ex. 1102 ¶¶ 137–144; Ex. 1108, 7:4–17; Ex. 1001, 8:50–54). Petitioner submits that Stokes discloses ranges that overlap with those disclosed in the '539 patent. *Id.* at 32–33. Furthermore, Petitioner argues that "Stokes discloses the routine optimization of average particle size to preferentially scatter blue light." *Id.* at 35 (citing Ex. 1102 ¶¶ 140–141) (footnote omitted). Petitioner asserts that "Stokes explicitly discloses selecting an average particle size that scatters excitation light at least 1.5 times as much as light emitted by the phosphor and gives an exemplary range of 0.10 to 0.20 microns (100 to 200 nm)." *Id.* at 35–36 (citing Ex. 1108, 7:4–17; Ex. 1124 ¶¶ 80–81). Thus, Petitioner submits that it would have been obvious to a person of ordinary skill to select an average particle size based on, among other things, the light scattering properties of the particles to arrive at the claimed range. *Id.* at 36–37 (citing Ex. 1102 ¶¶ 143–144).

b) Patent Owner's Contentions

At this time, Patent Owner argues that the Petition fails because it does not adequately show "an average particle size that is selected such that the light scattering material will scatter excitation light . . . relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material," which is recited by all of the independent claims. Prelim. Resp. 22–23. Patent Owner raises several reasons for this

contention. First, Patent Owner asserts that Petitioner fails to explain what theory it is relying on. *Id.* at 23–24. Second, Patent Owner argues that Krummacher "describes a vast range of particle sizes without identifying any part of that range as particularly beneficial or what the resulting benefits might be." *Id.* at 24–25. Patent Owner asserts that Krummacher is silent as to average particle size, and its disclosed range "would cover particle sizes where the blue light scattering is near equal with either green or red light." *Id.* at 26. Thus, Patent Owner argues that "there is no teaching of the claimed 'average particle size' from Krummacher's disclosure, and Petitioners' statement that 'Krummacher renders obvious this claim element' necessarily fails." *Id.*

With respect to Stokes, Patent Owner argues that the cited passages identify "**no particle sizes at all**," and "Stokes does not address *average* particle sizes." *Id.* at 27. Patent Owner also contends that "the Petition also fails to explain ***how*** a POSITA would have modified Krummacher in view of Stokes" nor "does the Petition explain why a POSITA would have been motivated to combine ***any*** of the teachings from these two very different prior art references, much less the additional teachings upon which Petitioners rely from the Shimizu reference." *Id.* at 27–28.

c) Analysis

With respect to the undisputed limitations of claim 1, we find that Petitioner has shown sufficiently that the combination of Krummacher, Stokes, and Shimizu accounts for those limitations. *See* Pet. 20–37. As for the motivation to combine the references, we find that Petitioner has shown sufficiently that a person of ordinary skill in the art would have been motivated to combine the references in the manner suggested. *See id.* at 27–28, 29–31, 36–37.

We focus our discussion on limitation 1[c]—"wherein the light scattering material has an average particle size that is selected such that the light scattering material will scatter excitation light from a radiation source relatively more than the light scattering material will scatter light generated by the at least one photoluminescence material." We find that Petitioner has shown sufficiently that the combination of Krummacher and Stokes teaches this limitation. First, we disagree with Patent Owner that Petitioner fails to identify which specific teaching the grounds rely upon. Prelim. Resp. 23–24. The Petition clearly sets out two theories for how the references teach this limitation, with citations to each reference and supporting explanation. *See* Pet. 26–27. In addition, the Petition provides additional explanation in its discussion of limitation 1[e]. *See id.* at 32–37. Thus, we find that the Petition has sufficient particularity.

We do not agree with Patent Owner's contention that Petitioner "identifies **no particle sizes at all**." Prelim. Resp. 27. The cited portions of Stokes state that "the radiation scattering particles have a size such that the particles preferentially scatter blue or UV LED light as compared to yellow, green, red or white light from the luminescent material." Ex. 1108, 7:1–4. Thus, we find that Stokes sufficiently discloses selecting a particle size. *See* Ex. 1102 ¶¶ 124–128.

We also find that Petitioner has shown sufficiently that Stokes discloses selecting an "average" particle size. As the Petition explains in the context of limitation 1[e], Stokes teaches selecting an exact particle size, and that "the average particle size of a set of exact theoretical particles is the same as the exact particle size." *See* Pet. 35 n.4 (citing Ex. 1102 ¶ 140 n.6).

Finally, we find that Petitioner has explained sufficiently the "*why*" and "*how*" the references would have been combined. As the Petition explains, Krummacher discloses radiation scattering particles having a size range of 50 to 1000 nm. *See* Pet. 26 (citing Ex. 1107 ¶ 39). Petitioner further explains that a person of ordinary skill in the art would use Stokes teachings to further refine that size range to optimize the particle size to preferentially scatter blue light. *See id.* at 26–27. Petitioner further provides reasons, suggested in Stokes itself, why a person of ordinary skill would have made this modification to Krummacher. *See id.* at 27–28 (citing Ex. 1108, 7:17–26; Ex. 1102 ¶ 128). Petitioner provides sufficient evidence that such a particle size selection was within the level of skill in the art at the time of the invention. *See* Ex. 1102 ¶¶ 122–128, 140–144; Ex. 1108, 7:1–17; Ex. 1124 ¶¶ 80–81. We note that we have reviewed the testimony of Patent Owner's expert, Dr. Schubert, but this testimony does not, at this stage, diminish the weight we give to Petitioner's expert. Thus, we find that Petitioner has shown sufficiently that the combination of Krummacher and Stokes accounts for this limitation and that a person of ordinary skill would have combined the references in the manner suggested with a reasonable expectation of success.

d) Summary as to Claim 1

We find that Petitioner has shown sufficiently that the combination of Krummacher, Stokes, and Shimizu accounts for all the limitations of claim 1 and that a person of ordinary skill in the art would have been motivated to combine Krummacher, Stokes, and Shimizu with a reasonable expectation of success. Patent Owner does not raise any secondary considerations of nonobviousness at this stage of the proceeding. Thus, we conclude for the reasons given that Petitioner has shown a reasonable likelihood of prevailing

in showing that claim 1 would have been obvious over the combination of Krummacher, Stokes, and Shimizu.

2. Claims 2–11, 18–20, 23–25

Patent Owner does not raise any other separate arguments regarding claims 2–11, 18–20, and 23–25 other than those we have considered above with respect to claim 1. *See* Prelim. Resp. 22–23. On the current record, we do not find Patent Owner's arguments persuasive, as explained above. We have reviewed Petitioner's contentions regarding claims 2–11, 18–20, and 23–25 (Pet. 37–45), and determine that Petitioner shows a reasonable likelihood of prevailing with respect to the obviousness of claims 2–11, 18–20, and 23–25 over Krummacher, Stokes, and Shimizu.

E. Alleged Ground of Unpatentability Over Hussell, Krummacher, Stokes, and Van Woudenberg

Petitioner contends that claims 18 and 28 of the '539 patent are unpatentable under 35 U.S.C. § 103 as obvious over Hussell, Krummacher, Stokes, and Van Woudenberg. Pet. 53–78.

Patent Owner relies on the same arguments considered above for claim 1. Prelim. Resp. 22–23. On the current record, we do not find Patent Owner's arguments persuasive, as explained above. We have reviewed Petitioner's contentions regarding claim 18 and 28 (Pet. 53–78), and determine that Petitioner shows a reasonable likelihood of prevailing with respect to the obviousness of claim 18 and 28 over Hussell, Krummacher, Stokes, and Van Woudenberg.

IV. CONCLUSION

After considering the arguments presented in the Petition, the Preliminary Response, and the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least one claim of the '539 patent is unpatentable. Thus, we institute an *inter partes* review of all challenged claims (i.e., claims 1–11, 18–20, 23–25, and 28) on all the grounds raised in the Petition.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–11, 18–20, 23–25, and 28 of the '539 patent is hereby ordered on all grounds of unpatentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this decision.

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