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Paper 25
Entered: April 11, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PLATINUM OPTICS TECHNOLOGY, INC.,
Petitioner,

v.

VIAVI SOLUTIONS INC.,
Patent Owner.

IPR2022-01489
Patent 11,131,794 B2

Before DEBRA K. STEPHENS, JOHN A. HUDALLA, and SHARON FENICK, *Administrative Patent Judges.*

PER CURIAM.

Opinion Concurring filed by *Administrative Patent Judge* FENICK.

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

I. INTRODUCTION

A. Background and Summary

Platinum Optics Technology, Inc. ("Petitioner") filed a Petition requesting *inter partes* review of claims 1–19 (the "challenged claims") of U.S. Patent No. 11,131,794 B2 (Ex. 1001, "the '794 patent"). Paper 1 ("Pet."). Viavi Solutions Inc. ("Patent Owner"), filed a Preliminary Response. Paper 7. On April 14, 2023 we determined that Petitioner would be reasonably likely to prevail with respect to at least one of the claims challenged in the Petition and instituted an *inter partes* review as to the challenged claims of the '794 patent. Paper 8 ("Decision on Institution" or "Inst. Dec."). Patent Owner filed a Response (Paper 12, "PO Resp.") on July 26, 2023. A Reply to the Patent Owner's Response (Paper 15, "Pet. Reply") was filed on November 1, 2023. On November 29, 2023, Patent Owner filed a Sur-reply (Paper 16, "PO Sur-reply"). On January 22, 2024, we held an oral hearing, a transcript of which (Paper 24, "Tr.") has been entered into the record.

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, after consideration of the complete record in this proceeding, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–19 of the '794 patent are unpatentable.

B. Real Parties in Interest

Petitioner represents that it is the only real party in interest. Pet. 69; Paper 19 (Petitioner's Updated Mandatory Notices). Patent Owner represents that it is the only real party in interest. Paper 4 (Patent Owner's Mandatory Notices), 2.

C. Related Matters

Petitioner and Patent Owner identify as related: (1) *Viavi Solutions Inc. v. Zhejiang Crystal-Optech Co. Ltd.*, No. 2:21-cv-00378, pending in the Eastern District of Texas; and (2) *Viavi Solutions Inc. v. Platinum Optics Technology Inc.*, No. 5:20-cv-06655, pending in the Northern District of California. Pet. 69; Paper 4, 2.

The parties describe as related additional *inter partes* review petitions that have been filed against the '794 patent or patents related by claims of priority to the '794 patent. Pet. 69 (identifying IPR2021-00631, IPR2022-01183, and IPR2022-01184); Paper 4, 2 (identifying IPR2022-01183, IPR2022-01184, and IPR2022-01281). Petitioner additionally notes that pending U.S. Patent Application No. 17/446,852 includes a priority claim to the application that issued as the '794 patent. Pet. 69.

D. The '794 Patent

The '794 patent, titled "Optical Filter and Sensor System," relates to optical filters useful in sensor systems that detect gestures based on near-infrared (NIR) light reflected from a user. Ex. 1001, code (54), 1:27–32. Figure 10, reproduced below, is a block diagram of a sensor system according to the '794 patent.

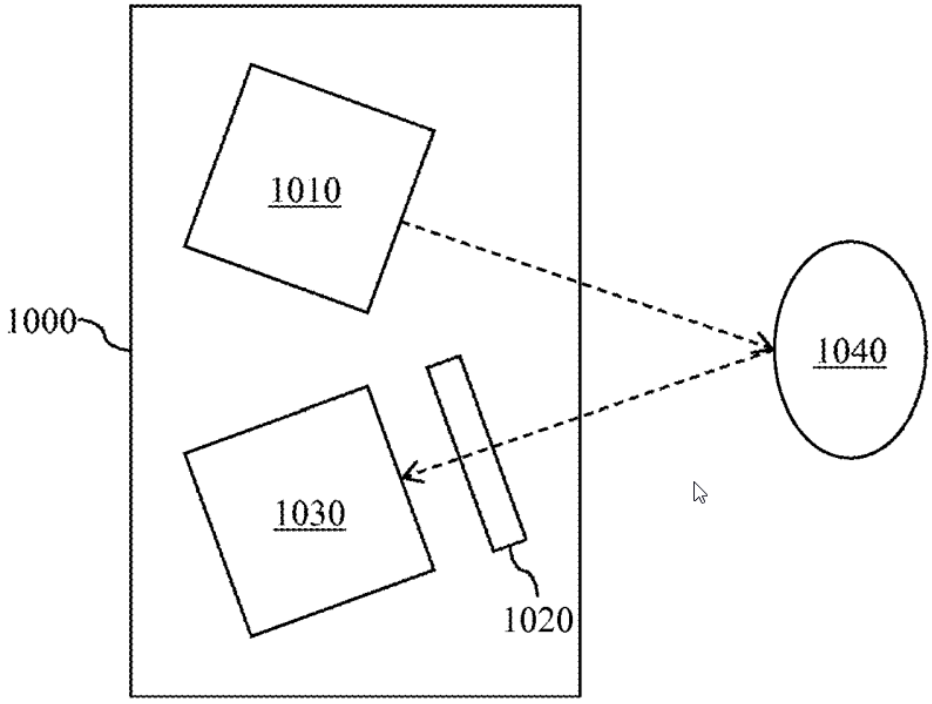

Figure 10 depicts sensor system 1000, which includes light source 1010 that emits NIR light toward target 1040. *Id.* at 9:48–51. Target 1040, in turn, reflects the emitted light toward sensor 1030. *Id.* at 9:59–61. Optical filter 1020 is disposed between the user and the sensor "to receive the emitted light after reflection by the target 1040." *Id.* at 9:64–65, 10:5–8. The '794 patent describes optical filter 1020 as a "narrow bandpass" filter because it transmits emitted light from light source 1010 in the NIR wavelength range of 800 nm to 1100 nm, while "substantially blocking ambient light." *Id.* at 1:33–41, 10:1–3.

Figure 6, reproduced below, illustrates a cross-section of the optical filter according to the '794 patent.

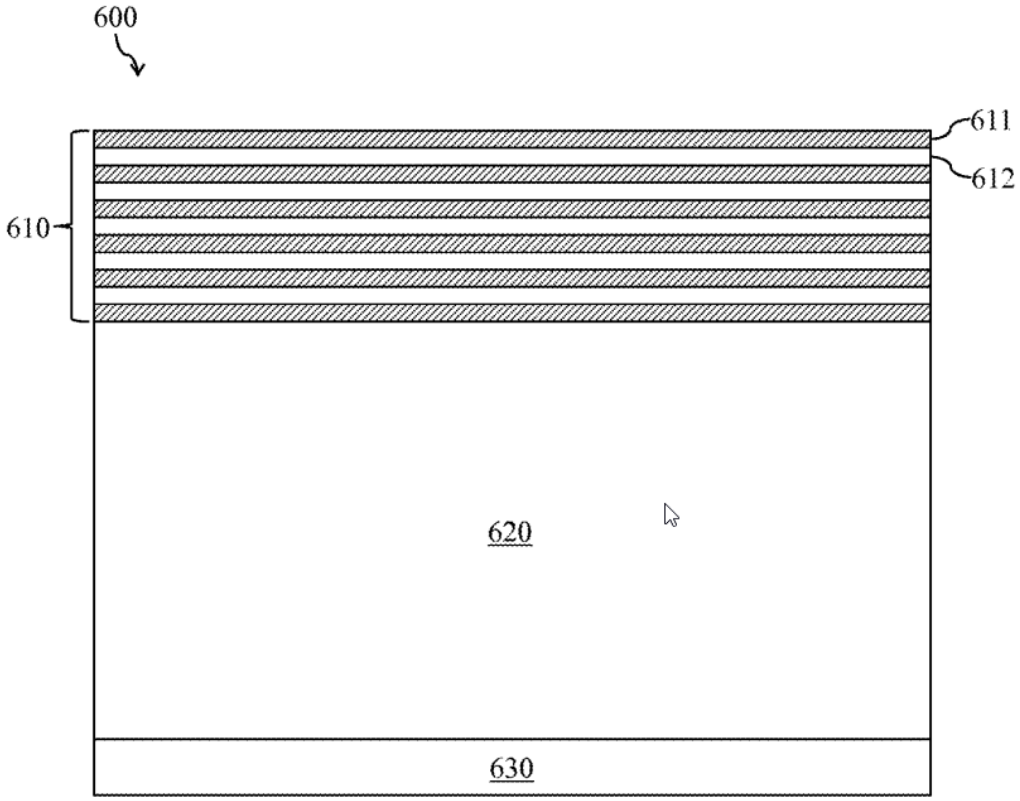

Figure 6 depicts optical filter 600 that includes filter stack 610 disposed on substrate 620, such as a glass substrate. *Id.* at 5:64–6:1. Filter stack 610 "includes a plurality of hydrogenated silicon [Si:H] layers 611, which serve as higher-refractive-index layers, and a plurality of lower-refractive-index layers 612 stacked in alternation." *Id.* at 6:9–12. "In most instances, the lower-refractive-index material is a dielectric material, typically, an oxide." *Id.* at 7:4–5. The '794 patent lists "[s]uitable lower-refractive-index materials" as "silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), titanium dioxide (TiO_2), niobium pentoxide (Nb_2O_5), tantalum pentoxide (Ta_2O_5), and mixtures thereof, i.e., mixed oxides." *Id.* at 7:5–9.

The Si:H layers have a refractive index of greater than 3 over a wavelength range of 800 nm to 1100 nm, while the lower-refractive-index layers have a refractive index of less than 3 over the wavelength range of 800 nm to 1100 nm. *Id.* at 2:59–67. In a preferred embodiment, the Si:H

layers have a refractive index of greater than 3.5 over the wavelength range of 800 nm to 1100 nm, for example "a refractive index of greater than 3.64, i.e., about 3.6, at a wavelength of 830 nm." *Id.* at 6:30–35. The '794 patent states that certain hydrogenated silicon materials would not have a suitably low extinction coefficient over the desired wavelength range. *Id.* at 2:35–53. The '794 patent additionally contains a description of the method of producing the hydrogenated silicon, which it describes as producing "improved hydrogenated silicon material." *Id.* at 4:24–28, 4:35–5:64, Figs. 4, 5A–5D.

According to the '794 patent, the disclosed optical filter improves over the prior art by minimizing the "center wavelength shift" in the filter's optical response as the angle of incident light varies. *Id.* at 2:10–17, 2:24–27. Specifically, the claimed optical filter has a center wavelength shift of less than 20 nm in response to a 0° to 30° change in an incidence angle. *Id.* at 7:58–62. The '794 patent states that a lower center wavelength shift allows for a "significantly narrower" passband that "improv[es] the signal-to-noise ratio of systems incorporating the" claimed optical filters. *Id.* at 8:35–39. The optical filter is described as preferably having a blocking level, outside of the passband, of greater than OD2[1] between 400 nm to 1100 nm. *Id.* at 7:42–46.

E. Illustrative Claims

Petitioner challenges claims 1–19 of the '794 patent. Pet. 1. Of the challenged claims, claims 1, 9, and 15 are independent and are reproduced below as illustrative of the subject matter recited in the challenged claims.

[1] "OD2" refers to a blocking level of a specific optical density, i.e., one in which 99% of the light is blocked. *See* Pet. 61 (citing Ex. 1002 ¶ 234); Ex. 1002 ¶ 249.

1. An optical device, comprising:

a near infrared band pass filter, comprising:

a substrate having a first side and a second side;

a first set of layers on the first side, wherein the first set of layers includes silicon and hydrogen;

a second set of layers on the first side, wherein the second set of layers includes oxygen; and

a third set of layers on the second side, whether the third set of layers includes oxygen.

Ex. 1001, 10:41–49.

9. An optical device, comprising:

a first set of layers including silicon and hydrogen; and

a second set of layers including oxygen;

wherein the optical device is a near infrared bandpass filter that has a center wavelength that shifts by less than 15 nm in magnitude with a change in incidence angle from 0° to 30°.

Id. at 10:65–11:4.

15. An optical system, comprising:

a light source for emitting light having a wavelength between 800–1100 nm; and

a filter comprising:

a first set of layers including silicon and hydrogen; and

a second set of layers including oxygen;

wherein the filter is designed for substantially allowing light in a wavelength range that includes the wavelength between 800–1100 nm to pass through it and exhibits a blocking level greater than OD2 between 400 nm to 1100 nm but outside of the wavelength range.

Id. at 11:17–12:5.

F. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Tsai et al., US 5,398,133, issued Mar. 14, 1995 ("Tsai")[2]	1020
Bamji, US 6,323,942 B1, issued Nov. 27, 2001 ("Bamji")	1026
Erdogan, et al., US 6,809,859 B2, issued Oct. 26, 2004 ("Erdogan")	1019
Pilgrim, US 2012/0224061 A1 (pub. Sept. 6, 2012) ("Pilgrim")	1021
Hendrix et al., US 2014/0014838 A1 (pub. Jan. 16, 2014) ("Hendrix")	1017
Hidehiko Yoda et al., a-*Si:H/SiO$_2$ multilayer films fabricated by radio-frequency magnetron sputtering for optical filters*, APPLIED OPTICS 43(17):3548–54 (2004) ("Yoda")	1022
B. M. Lairson et al., *Reduced Angle-Shift Infrared Bandpass Filter Coatings*, Proc. of SPIE Vol. 65451C-1–65451C-5, Window and Dome Technologies and Materials X (2007) ("Lairson")[3]	1018

Petitioner additionally submits a declaration of Dr. James D. Rancourt, Exhibit 1002.

Patent Owner submits a declaration of Dr. Bruce Clemens, Exhibit 2001.

[2] The parties refer to this exhibit as "Tsai-133" in their papers.
[3] When citing to Lairson, we omit the "65451C-" prefix, referring only to the ending page number.

G. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §[4]	References
1–19	102	Hendrix
1–3, 6	103	Lairson, Erdogan
1–3, 6	103	Lairson, Tsai
7	103	Lairson, Erdogan, Bamji
7	103	Lairson, Tsai, Bamji
1–3, 6	103	Yoda, Tsai
7	103	Yoda, Tsai, Bamji
8	103	Yoda, Tsai, Pilgrim
9–11, 13, 14	103	Pilgrim, Yoda
15–17	103	Pilgrim, Erdogan, Yoda
18, 19	103	Pilgrim, Erdogan, Yoda, Tsai

Pet. 6–7.

II. ANALYSIS

A. Legal Standards

"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")). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800

[4] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. §§ 102 and 103. Petitioner argues that the claims are not entitled to the benefit of priority claims to applications filed before March 16, 2013, the effective date of the applicable AIA amendments, and that therefore it refers to post-AIA statutes. Pet. 1, 6 n.1, 11–22; *see infra* § II.D.1. We agree. However, the outcomes in this Final Written Decision would be the same whether we apply the AIA or the pre-AIA version of the statutes.

F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review).

Furthermore, Petitioner must explain with particularity how the prior art would have rendered the challenged claims unpatentable. 35 U.S.C. § 312(a)(3); 37 C.F.R. § 42.104(b)(4) ("The petition must specify where each element of the claim is found in the prior art patents or printed publications relied upon.").

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *See Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001).

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the claimed invention, as a whole, would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention 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 skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.[5] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

[5] The trial record does not contain any arguments or evidence relating to secondary considerations.

B. Level of Ordinary Skill in the Art

The level of skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 1323–1324 (Fed. Cir. 1999) (citing *Graham*, 383 U.S. at 17–18; *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Petitioner argues that a person of ordinary skill in the art ("POSA") would have had:

> a Bachelor's degree or equivalent in physics, or in a related science or engineering field, along with at least 5 years of experience in optical coating design and the manufacturing of optical filters, including various deposition techniques. Additional education (e.g., a Master's degree with exposure to coating design and manufacturing) may substitute for some industrial experience in optical thin film design, and more industrial experience can substitute for a different educational background.

Pet. 10; *see* Ex. 1002 ¶ 72.

In the Decision on Institution, we adopted a slightly modified version of this definition in which we removed the open-ended term "at least." Inst. Dec. 10–11. Patent Owner does not address the definition of a POSA. *See generally* PO Resp. Patent Owner's declarant Dr. Clemens applies Petitioner's definition, but does not opine on whether it is correct. Ex. 2001 ¶¶ 22–23.

As in the Decision on Institution (Inst. Dec. 10), we apply the same slightly modified version of Petitioner's definition of the level of ordinary skill in the art that removes the open-ended term "at least." We determine this level of skill comports with the qualifications a person would have needed to understand and implement the teachings of the '794 patent and the

prior art of record. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art itself may reflect an appropriate level of skill in the art).

C. Claim Construction

1. "whether the third set of layers includes oxygen" – claim 1

Claim 1 contains a limitation that the recited near infrared band pass filter comprises "a third set of layers on the second side, whether the third set of layers includes oxygen." Ex. 1001, 10:41–49. Petitioner argues that the proper construction of this limitation "means that there is a third set of layers on the opposite side of the substrate, whether or not [the layers] include oxygen" – i.e., that the third set of layers do not need to include oxygen. Pet. 7–8. Patent Owner agrees that this is the "literal" reading of the language, but contends that one of ordinary skill in the art "would have appreciated that this language was intended to read 'wherein' rather than 'whether'" and that the claim requires that this set of layers must include oxygen. PO Resp. 24–26 (citing Ex. 2001 ¶¶ 53–55).

We agree with Petitioner's representation that each of the challenges presented either anticipates or renders obvious a third set of layers with oxygen on a second side of a substrate (Pet. 8) and therefore, no claim construction is necessary for this term. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

2. "the first set of layers includes silicon and hydrogen" – claim 1
"a first set of layers including silicon and hydrogen" – claims 9 and 15

Claim 1 contains a limitation that the recited near infrared band pass filter comprises "a first set of layers on the first side, wherein the first set of

layers includes silicon and hydrogen." Ex. 1001, 10:41–49. Claim 9 recites that the claimed optical device comprises "a first set of layers including silicon and hydrogen." *Id.* at 10:65–11:4. Claim 15 similarly recites that the claimed optical system comprises a filter comprising "a first set of layers including silicon and hydrogen." *Id.* at 11:17–12:5.

The construction of these claim terms is relevant to the extent it informs the parties' dispute over whether Hendrix qualifies as prior art to the '794 patent, relating to the ground asserting that Hendrix anticipates all claims. *See* Pet. 8, 11–29. With respect to the other grounds before us, the construction is not relevant, as in each of these grounds, as discussed in Sections E–G below, the ground relies on a teaching or suggestion of layers of hydrogenated silicon, and there is no dispute that such layers would be encompassed by "layers including silicon and hydrogen." Thus, we only address this claim construction to the extent needed to resolve the controversy regarding the Hendrix anticipation ground, in Section II.D, below.

3. Other Claim Terms

No additional claim terms require construction to resolve the controversy before us. *See Realtime Data*, 912 F.3d at 1375.

D. Anticipation – Hendrix

Petitioner argues that Hendrix is prior art to the '794 patent and that all claims are anticipated by Hendrix. Pet. 8, 11–29. Patent Owner disputes that Hendrix is prior art to the '794 patent. PO Resp. 27–44; PO Sur-reply 6–17.

Hendrix is a publication of U.S. Patent Application No. 13/943,596 ("the '596 application"). Ex. 1017, code (21). Both Petitioner and Patent Owner agree that the application that issued as the '794 patent claims

priority, through a series of continuation applications, to the '596 application. Pet. 8; PO Resp. 9; Ex. 1001, code (63).

The issue of whether Hendrix qualifies as prior art to the '794 patent turns on the issue of whether the claims of the '794 patent have adequate written description support in the '596 application.

1. Our Analysis – Qualification of Hendrix as Prior Art

a) Claim Construction

Patent Owner argues that an ordinarily skilled artisan would have understood "layers including silicon and hydrogen"[6] as "simply specifying physical layers including silicon and hydrogen in them—structural requirements." PO Resp. 42 (citing Ex. 2001 ¶ 78). Petitioner agrees with this argument. Pet. Reply 4; *see also* Pet. 14–15. Notwithstanding, Patent Owner argues that an ordinarily skilled artisan would have understood that "this claimed term does not encompass materials that are not usable for the claimed NIR bandpass filters (which include a first set of layers as claimed), when reading the claim as a whole." PO Sur-reply 5 (citing Ex. 2001 ¶ 72); *see also* PO Resp. 39–40 (similar argument).

In addition, Petitioner argues that "layers including silicon and hydrogen" is a genus limitation. Pet. 15. Patent Owner disputes "layers including silicon and hydrogen" defines a genus. PO Resp. 26–27, 29–41; PO Sur-reply 15–17.

[6] Throughout this section, we reference the claim 9 and 15 formulation of "layers including silicon and hydrogen," though the discussion is equally applicable to claim 1, which includes a very slight difference in wording ("a first set of layers on the first side, wherein the first set of layers includes silicon and hydrogen").

We start with the ordinary meaning of the terms themselves (*Phillips*, 415 F.3d at 1314): "a first set of layers on the first side, wherein the first set of layers includes silicon and hydrogen" (claim 1) and "a first set of layers including silicon and hydrogen" (claims 9 and 15). Ex. 1001, 10:41–49, 10:65–11:4, 11:17–12:5. As the parties agree, these recitations are broadly worded. *See* Pet. 14 (describing the recitations of the claims as "broad" and directed to "layers of any material that has both 'silicon and hydrogen'"); PO Resp. 42 (describing the claims as "simply specifying physical layers including silicon and hydrogen in them"), 44 (describing the disputed terms as "open-ended claiming of layers including hydrogen and silicon"). Despite this broad language, Patent Owner contends that we must read "layers including silicon and hydrogen" in conjunction with other limitations in the claims reciting a "near infrared bandpass filter." PO Resp. 35–37 (citing Ex. 2001 ¶¶ 65–66). For purposes of our analysis, we limit "layers including silicon and hydrogen" to only materials suitable for NIR bandpass filters, as suggested by Patent Owner.

We next examine the rest of the intrinsic evidence. The specification of the '794 patent does not contain language that generally describes "layers including silicon and hydrogen." Instead, the specification describes only layers of hydrogenated silicon: its abstract is directed to an "optical filter" that "includes a filter stack formed of hydrogenated silicon layers" (Ex. 1001, code (57)); the technical field of the invention is described as "relat[ing] to optical filters including hydrogenated silicon layers and to sensor systems comprising such optical filters" (*id.* at 1:20–23); the summary of the invention describes "the present invention" as an optical filter or sensor system "comprising" "a plurality of hydrogenated silicon layers" (*id.* at 2:57–3:19); and the detailed description begins with a

statement that "the present invention provides an optical filter including hydrogenated silicon (Si:H) layers" (*id.* at 4:19–20). The specification only mentions silicon and hydrogen separately with respect to the disclosed sputter-deposition system "used to produce the hydrogenated silicon material." *Id.* at 4:35–5:61, 7:10–19. In particular, the specification describes how "cathode 430 includes a silicon target 431, which is sputtered in the presence of hydrogen (H_2), as well as an inert gas such as argon, to deposit the hydrogenated silicon material as a layer on the substrate 420." *Id.* at 4:44–47. The specification also describes how altering the hydrogen flow rate in the deposition process affects the optical properties of hydrogenated silicon produced by the deposition system. *See id.* at 5:1–61. But the only end product described from the sputter-deposition process using silicon and hydrogen is hydrogenated silicon. *See id.* at 4:35–5:61, 7:10–19. As such, the specification does not provide any indication of materials beyond hydrogenated silicon that are within the scope of "layers including silicon and hydrogen."

Next, we consider the extrinsic evidence regarding "layers of silicon and hydrogen," and for purposes of our analysis, we limit our discussion to evidence of materials that are suitable for NIR filters.[7] Petitioner's expert, Dr. Rancourt, testifies an ordinarily skilled artisan "would have been aware

[7] Dr. Rancourt testifies about certain other materials within the scope of "layers of silicon and hydrogen" that would not be suitable for interference filters. *See, e.g.*, *id.* ¶¶ 124, 125, 127, 128; Ex. 2003, 120:3–123:3, 104:18–105:10. Patent Owner highlights this testimony as evidence that "Petitioner's 'genus' argument, which relies on Dr. Rancourt's class as its basis, lacks merit." PO Resp. 37–41; *see also* PO Sur-reply 5–6 (similar argument). Yet, for the reasons discussed herein, the extrinsic evidence of record supports a genus interpretation even when we exclude such unsuitable materials from our analysis.

of numerous other types of materials that include both silicon and hydrogen, but which are not described in the '596 application." Ex. 1002 ¶ 122. Dr. Rancort points to the Tsai-133 reference, which describes "use of hydrogenated silicon nitrade, SiNx:H[,] which has a refractive index of 1.82 at 500 nm." *Id.* (citing Ex. 1020, 1:66, 4:7–25). Dr. Rancort also identifies "[o]ther types of materials including both silicon and hydrogen, but that are not hydrogenated silicon," including "'high-oxygen doped hydrogenated silicon carbide,' or hydrogenated silicon oxycarbide"; "hydrogenated silicon carbonitride" and "hydrogenated silicon dioxide." *Id.* ¶ 123 (citing Ex. 1013, 3:63–65; Ex. 1014, 27:53–57; Ex. 1015, 5:15–19). Dr. Rancourt further testified that "[o]n the basis of history, there are a whole number of materials that are known to work and some others that are not known to work. And I'm sure there are many more which haven't been checked yet." Ex. 2003, 94:16–95:1.

Dr. Clemens does not dispute that the materials mentioned in paragraphs 122 and 123 of Dr. Rancourt's declaration are materials within the scope of "layers of silicon and hydrogen" that are suitable for interference filters. Indeed, at his deposition, Dr. Clemens stated that he was not asked to opine on the set of suitable filter materials within the scope of "layers including silicon and hydrogen," though he acknowledged there would be materials other than hydrogenated silicon. Ex. 1051, 68:23–70:16. Dr. Clemens further testifies that an ordinarily skilled artisan "would understand that materials that cannot be used to make the claimed optical devices would not fall within the scope of the claims (because the claims require specific optical devices)." Ex. 2001 ¶ 72.

Thus, the testimony from both experts shows that the phrase "layers including silicon and hydrogen" covers numerous materials suitable for NIR

filters other than just hydrogenated silicon. Dr. Rancourt names many of them in his declaration and opines that many more have not yet been checked for suitability. Ex. 1002 ¶¶ 122–123; Ex. 2003, 94:16–95:1. Patent Owner did not dispute this testimony. Thus, the extrinsic evidence supports that numerous filter materials are within the scope of "layers including silicon and hydrogen."

For these reasons, and in light of the specification's singular focus on hydrogenated silicon, we determine the recitation "layers including silicon and hydrogen" is a generic recitation encompassing the sole species described in the specification, which is hydrogenated silicon. *See* Ex. 1017 ¶ 2 ("[T]he present invention relates to optical filters including hydrogenated silicon layers . . . ."). The evidence of record shows that "layers including silicon and hydrogen" is broader than layers including hydrogenated silicon insofar as filter materials other than hydrogenated silicon—both known and unknown—are within the scope of the claim. Thus, even under Patent Owner's constraint that layer materials must be suitable for NIR bandpass filters, we determine that "layers including silicon and hydrogen" should be treated as a genus claim limitation.

b) Written Description

Because the Petitioner met its initial burden of production in this case in its arguments that Hendrix anticipates claims of the '794 patent (*see infra* § II.D.2), the burden of production shifted to Patent Owner to show that the '794 patent is entitled to an earlier date. *See Dynamic Drinkware*, 800 F.3d at 1380.

Patent Owner argues that Petitioner bears the burden of persuasion in establishing Hendrix is prior art. PO Resp. 28–29 (citing *SPTS Techs. v. Plasma-Therm*, IPR2018-00618, Paper 24, 41 (PTAB Aug. 26, 2019)).

While the petitioner always bears the ultimate burden of persuasion, we analyze the evidence presented to determine whether Patent Owner has met Patent Owner's "burden of production . . . to argue or produce evidence that" Hendrix "is not prior art because the . . . claims in the ['794] patent are entitled to the benefit of" Hendrix's filing date. *See Dynamic Drinkware*, 800 F.3d at 1380; *Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1372 (Fed. Cir. 2023). *Dynamic Drinkware* described Patent Owner's "burden to prove" entitlement to the benefit of a filing date once it was properly placed at issue. *Dynamic Drinkware*, 800 F.3d at 1381.

Patent Owner argues that the present case is distinguishable from *Dynamic Drinkware* because it involves no previous consideration of priority, while in the present case, the Examiner already made a determination regarding written description support for the claims, and therefore Petitioner bears the burden of establishing examiner error. PO Sur-reply 7–8 (citing *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8, 24 (PTAB Dec. 15, 2017) (precedential); *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 9–10 (PTAB Feb. 13, 2020) (precedential)). However, *Becton, Dickinson* and *Advanced Bionics* relate to denial of institution under 35 U.S.C. § 325(d), and these cases do not affect the considerations before us at this stage with respect to the burdens of the parties in this situation. PO Sur-reply 8; *see Becton, Dickinson*, 24; *Advanced Bionics*, 8.

As stated above, we determine that "layers including silicon and hydrogen" defines a genus. The test for providing a written description that supports a genus claim is whether the description provides "either a representative number of species falling within the scope of the genus or

structural features common to the members of the genus so that one of skill in the art can 'visualize or recognize' the members of the genus." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1350 (Fed. Cir. 2010) (en banc). "Regarding whether common structural features must exist between a claim and a putative priority disclosure, those features must constitute the near-entirety of the structures being compared." *Regents of the Univ. of Minnesota v. Gilead Scis., Inc.*, 61 F.4th 1350, 1358 (Fed. Cir. 2023).

Yet the patentees only disclosed hydrogenated silicon as a possible species. Indeed, the specification focuses on a singular example of a sputter-deposition system that is used to produce an improved hydrogenated silicon material. *See* Ex. 1017 ¶¶ 36–38. Patent Owner cites this deposition process as written description support for "the claimed layers containing silicon and hydrogen." *See* PO Resp. 44. But this example supports only how to make hydrogenated silicon and does not include any indication about what other materials would be within the scope of the claimed genus. Under these circumstances, the specification's disclosure of a single species is not an adequate number to show possession of the entire genus of "layers including silicon and hydrogen."

Beyond the disclosure of the sputter-deposition process for producing hydrogenated silicon, Patent Owner does not identify—and we cannot discern—any other examples of a "structure, formula, chemical name, physical properties, or other properties, of species falling within the genus sufficient to distinguish the genus from other materials." *Ariad*, 598 F.3d at 1350. This is particularly noteworthy given that undisputed record evidence shows numerous other potential filter materials "including silicon and hydrogen." *See supra* § II.D.1.a. In the absence of structural description supporting "layers including silicon and hydrogen," we determine that an

ordinarily skilled artisan cannot "visualize or recognize" the members of the genus based on disclosed structural features. *Ariad*, 598 F.3d at 1350.

We also have considered Patent Owner's argument that an ordinarily skilled artisan "would have understood that the claimed layers must form NIR bandpass filters" based on express limitations in the challenged claims reciting the same. *See, e.g.*, PO Resp. 37 (citing Ex. 2001 ¶¶ 65–66); PO Sur-reply 5 (citing Ex. 2001 ¶ 72). This argument is tantamount to treating "layers including silicon and hydrogen" as a functional genus insofar as the chosen layer material would have to function in NIR bandpass filters.[8] As such, "the specification must demonstrate that the applicant has made a generic invention that achieves the claimed result and do so by showing that the applicant has invented species sufficient to support a claim to the functionally-defined genus." *Ariad*, 598 F.3d at 1349. As discussed above, however, the specification includes only a single example of how to create "layers including silicon and hydrogen" suitable for such filters, which is the disclosed process for creating "improved hydrogenated silicon material." *See* Ex. 1017 ¶¶ 35–39. Nor does the specification include information on how materials "including silicon and hydrogen" might be chosen to attain a functional NIR bandbass filter. As such, we find this to be a situation where "the functional claim . . . claim[s] a desired result . . . without describing species that achieve that result." *Ariad*, 598 F.3d at 1349. Thus, we find

[8] We acknowledge that "no party takes the position that the term is functional" (Pet. Reply 5) and that the record includes some evidence that "layers including hydrogen and silicon" is a structural limitation. *See, e.g.*, PO Resp. 30–31 (citing Ex. 2001 ¶¶ 58–59; Ex. 2003, 101:1–17). Notwithstanding, Patent Owner's arguments about choosing materials based on suitability for NIR bandpass filters undermines Patent Owner's suggestion that the limitation is purely structural.

that the specification does not adequately support "layers including silicon and hydrogen" to the extent it is a functionally-defined genus.

Patent Owner additionally suggests that "layers including silicon and hydrogen" might cover impurities found with hydrogenated silicon. PO Resp. 42–43. Yet this suggestion is fatally inconsistent with Patent Owner's argument that an ordinarily skilled artisan would have known to choose materials in the genus based on their usefulness in a filter, because an ordinarily skilled artisan would not have chosen impurities. *See* Ex. 1051, 67:2–16 (Dr. Clemens testifying that impurities could cause variances in the optical properties of a filter).

For these reasons, we find that the written description does not provide adequate support for the genus of "layers including silicon and hydrogen."

As a result of these findings, we determine that the '794 patent is not entitled to the filing date of the '596 application, and therefore Hendrix qualifies as a printed publication for purposes of this *inter partes* review.

2. Anticipation by Hendrix

We review Petitioner's arguments for anticipation by Hendrix (Pet. 22–29) to determine whether Hendrix discloses each claim. While Patent Owner relies only on its argument that Hendrix does not qualify as prior art, the burden remains with Petitioner to make the showing regarding the unpatentability of each claim as anticipated by Hendrix. We address the independent claims first, then the dependent claims.

a) Claim 1

Petitioner argues that Hendrix discloses "[a]n optical device" [9] comprising "a near infrared band pass filter" in its disclosure of a sensor system including a NIR band pass filter. Pet. 22–23 (citing Ex. 1017 ¶¶ 4, 68, 70, Fig. 10 (element 1020)). Petitioner argues that the substrate, first set of layers ("includ[ing] silicon and hydrogen"), and second set of layers are disclosed by optical filter 600, which includes a substrate 620 and two sets of layers, hydrogenated silicon layers 611 and lower-refractive index layers 612 that are typically an oxide or mixed oxides. *Id.* at 23 (citing Ex. 1017 ¶¶ 44–46, 51, Fig. 6). Petitioner argues that the third set of layers on the second side is disclosed by the antireflective coating 630, typically Ta_2O_5/SiO_2 (and thus including oxygen) disposed on the second side of the substrate in Hendrix. *Id.* at 23–24 (citing Ex. 1017 ¶¶ 45, 57–58, Fig. 7B).

We have examined each of Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 1 is anticipated by Hendrix.

b) Claim 9

Petitioner argues that Hendrix discloses "[a]n optical device" comprising "a near infrared band pass filter" in its disclosure of a sensor system including a NIR band pass filter. Pet. 25–26 (citing Ex. 1017 ¶¶ 4, 68, 70, Fig. 10 (element 1020)). Petitioner argues that the substrate, first set of layers, and second set of layers are disclosed by optical filter 600, which

[9] We do not determine whether the preamble to any of the claims is limiting, because we determine that, regardless of whether any preamble is limiting, Petitioner has shown that the prior art in each ground satisfies the recitation in the preambles.

includes a substrate 620 and two sets of layers, hydrogenated silicon layers 611 and lower-refractive index layers 612 that are typically an oxide or mixed oxides. *Id.* at 26 (citing Ex. 1017 ¶¶ 46, 51, Fig. 6). Petitioner argues that the filter's properties as claimed in claim 9 ("a center wavelength that shifts by less than 15 nm in magnitude with a change in incidence angle from 0° to 30°") is disclosed in Hendrix's disclosure that the center wavelength of the filter shifts by 12.2 nm with the stated change in angle of incidence ("AOI"). *Id.* (citing Ex. 1017 ¶ 59, Fig. 7A).

We have examined each of Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 9 is anticipated by Hendrix.

c) Claim 15

Petitioner argues that Hendrix discloses the optical system of the preamble in its disclosure of a sensor system. Pet. 27 (citing Ex. 1017 ¶¶ 68, 33, Fig. 10). For the light source of the first limitation, Petitioner argues that Hendrix discloses this in its light source 1010 that emits light at the wavelength stated in the limitation. *Id.* at 27–28 (citing Ex. 1017 ¶ 69). As with claims 1 and 9, Petitioner argues that the filter comprising the first and second set of layers is disclosed in Hendrix's Figure 6 and related disclosure, which discloses a filter stack with hydrogenated silicon layers 611 and lower refractive index layers 612, and that these lower refractive index layers would be an oxide or mixed oxides. *Id.* at 28 (citing Ex. 1017 ¶¶ 46, 51, Fig. 6 (elements 610, 611, 612). Petitioner argues that the filter's properties as claimed in claim 15 ("substantially allowing light in a wavelength range that includes the wavelength between 800-1100 nm to pass through it and exhibits a blocking level greater than OD2 between 400 nm to 1100 nm but

outside of the wavelength range") are disclosed by Hendrix's disclosure of filters with these characteristics. *Id.* at 28–29 (citing Ex. 1017 ¶¶ 54, 70).

We have examined each of Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 15 is anticipated by Hendrix.

d) Claims 2, 3, 10, and 11

Petitioner argues that Hendrix discloses a lower-refractive index material that is SiO_2, and an anti-reflective (AR) coating including SiO_2, each disclosing a second set and third set of layers including silicon (claims 2 and 10) and second set and third set of layers of silicon dioxide (claims 3 and 11). Pet. 24, 27 (citing Ex. 1017 ¶¶ 45, 51, 57–58, Fig. 7B, 7C, 8B, 9A).

We have examined each of Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claims and the claims as a whole, as per Petitioner's assertions. Thus, we determine that claims 2, 3, 10, and 11 are anticipated by Hendrix.

e) Claims 4 and 12

Petitioner argues that Hendrix discloses a third set of layers including tantalum in the disclosure that the AR coating includes tantalum pentoxide. Pet. 24, 27 (citing Ex. 1017 ¶¶ 45, 51, 57–58, Fig. 7B).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claims and the claims as a whole, as per Petitioner's assertions. Thus, we determine that claims 4 and 12 are anticipated by Hendrix.

f) Claim 5

Petitioner argues that Hendrix discloses a second set of layers including titanium in the disclosure that lower refractive index layers in Hendrix can include titanium dioxide. Pet. 24 (citing Ex. 1017 ¶ 51).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 5 is anticipated by Hendrix.

g) Claim 6

Petitioner argues that Hendrix discloses filter stacks with 48, 25, or 29 layers, thus disclosing a total number of layers on the first side between 25 and 48, as claimed in claim 6. Pet. 25 (citing Ex. 1017 ¶¶ 58, 62, 66).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 6 is anticipated by Hendrix.

h) Claim 7

Petitioner argues that Hendrix discloses the use of the optical device in a 3D image sensing system as claimed in claim 6. Pet. 25 (citing Ex. 1017 ¶¶ 68, 72).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 7 is anticipated by Hendrix.

i) Claims 8 and 14

As discussed above with reference to claim 9, Petitioner argues that a filter with properties as claimed in claim 8 and 14 ("a center wavelength that

shifts by less than 15 nm in magnitude with a change in incidence angle from 0° to 30°") is disclosed by Hendrix's disclosure that the center wavelength of the filter shifts by 12.2 nm when the incidence angle changes from 0° to 30°. Pet. 25, 27 (citing Ex. 1017 ¶ 59, Fig. 7A).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claims and the claims as a whole, as per Petitioner's assertions. Thus, we determine that claim 8 and 14 are anticipated by Hendrix.

j) Claim 13

Petitioner argues that a filter with properties as claimed in claim 13 (filter that "has a full width half maximum (FWHM) that is less than 50 nm") is disclosed in Hendrix's disclosure of a passband with that FWHM. Pet. 27 (citing Ex. 1017 ¶ 55).

We have examined Petitioner's citation and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 13 is anticipated by Hendrix.

k) Claim 16

Petitioner argues that a filter with properties as claimed in claim 16 ("a blocking level of greater than OD3 for wavelengths between 300 nm to 1100 nm") is disclosed in Hendrix's disclosure of a filter "preferably" having these characteristics. Pet. 29 (citing Ex. 1017 ¶ 54).

We have examined Petitioner's citation and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 16 is anticipated by Hendrix.

l) Claim 17

Petitioner argues that a filter with properties as claimed in claim 17 ("a center wavelength that shifts by less than 20 nm in magnitude with a change in incidence angle from 0° to 30°") is disclosed in Hendrix's disclosure of a filter with such a passband. Pet. 29 (citing Ex. 1017 ¶¶ 56, 59, Fig. 7A).

We have examined Petitioner's citation and determine that Hendrix, in the cited portions, discloses each element of the claim and the claim as a whole, as per Petitioner's assertions. Thus, we determine that claim 17 is anticipated by Hendrix.

m) Claims 18 and 19

Claim 18 and 19 each require that the optical system of claim 15 have the first and second set of layers on the first side of a substrate. Ex. 1001, 12:13–21. Claim 18 requires an AR coating on the second side of the substrate and claim 19 that a third set of layers that includes oxygen is on a second side of the substrate. *Id.*

Petitioner argues that Hendrix discloses first and second sets of layers on a first side of a substrate and an AR coating including oxygen on the second side of the substrate, thus disclosing the additional limitations of these claims. Pet. 23–24, 29 (citing Ex. 1017 ¶¶ 45, 57–58, Fig. 6, 7B).

We have examined Petitioner's citations and determine that Hendrix, in the cited portions, discloses each element of the claims and the claims as a whole, as per Petitioner's assertions. Thus, we determine that claim 18 and 19 are anticipated by Hendrix.

n) Conclusion

For the reasons presented above, we determine that Petitioner has shown, by a preponderance of the evidence, that each of claims 1–19 is anticipated by Hendrix.

E. Lairson Grounds

Petitioner argues that claims 1–3 and 6 would have been obvious over the combinations of Lairson and Erdogan or Lairson and Tsai. Pet. 30–39. Petitioner additionally argues that claim 7 would have been obvious over the combinations of Lairson, Erdogan or Tsai, and Bamji. *Id.* at 39–41.

Patent Owner presents various arguments against these assertions. PO Resp. 44–51; PO Sur-reply 18–19, 20–21.

1. Lairson (Ex. 1018)

Lairson, which was discussed in the '794 patent specification (Ex. 1001, 2:35–53), describes bandpass optical filters, including "several designs that have been achieved via hydrogenated silicon in multilayers, with improved performance at oblique angles of incidence." Ex. 1018, 1. In particular, Lairson studied films that include hydrogenated silicon deposited by magnetron sputtering and having a refractive index of 3.2 at a wavelength of 1500 nm. *Id.* at 1–2. According to Lairson, "[b]andpass filters which perform acceptably over a wide angular range typically require extinction coefficients of less than about 1 x 10^{-03} in the bandpass wavelength range," and through "proper optimization" of the sputtering process, "acceptable extinction coefficients were obtained for wavelengths above 1000 nm." *Id.* at 2.

Lairson constructed a shortwave-pass edge filter from Si:H and silicon nitride (Si:H-Si_3N_4), and reports that the performance of this filter was "considerably better than the performance achievable with lower index

materials," such as a filter fabricated with niobia and silica (Nb_2O_5-Si_3H_4). *Id.* at 3. Lairson describes as "[n]ot surprising[]" certain advantages exhibited by the Si:H-Si_3N_4 filter, as compared to the Nb_2O_5-Si_3N_4 filter. *Id.* "Perhaps more surprising," Lairson adds, "is the reduced thickness and sharper edge of the [Si:H-Si_3N_4] filter." *Id.*

Figure 4 of Lairson is reproduced below.

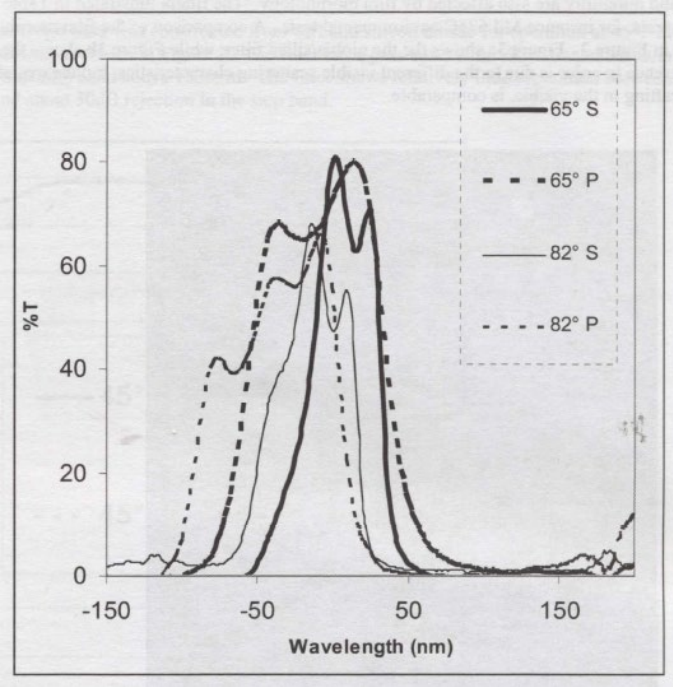

Figure shows transmission spectra for a Si:H-SiO_2 filter at a bandpass of 65º and 82º. *Id.* at 4–5. From these spectra, Lairson observes that "[t]his filter achieves greater than 50% transmission at the wavelength of interest over this angular range, with a bandpass width of approximately 50nm." *Id.* at 4. Lairson concludes that the use of Si:H as a high-index material in the filter structure "dramatically improved" the filter capability when compared with a comparable design made from niobia and silica. *Id.* More generally, "[t]he availability of higher index materials enables the fabrication of designs with improved performance and reduced thickness," and "[t]he advantage of higher refractive index is particularly compelling for filters

which must operate over a range of angles with both s and p polarizations." *Id.* at 5.

2. Erdogan (Ex. 1019)

Erdogan relates to an optical filter with a first thin-film interference filter disposed on a first surface of a substrate, and a second thin-film interference filter disposed on a second surface of the substrate. Ex. 1019, code (57), 1:14–15, 2:42–57. The first interference filter includes a plurality of alternating high and low index of refraction layers. *Id.* at 2:47–50. The second interference filter includes a second plurality of alternating high and low index of refraction layers. *Id.* at 2:50–54. Erdogan describes the first and second layers as being configured to transmit different wavelengths, "thereby establishing a bandpass transmission characteristic" for the resulting filter. *Id.* at 2:47–57.

An exemplary embodiment includes a long-wave-pass filter on a first surface of a substrate and a short-wave-pass filter on a second surface of the substrate. *Id.* at 5:37–41.

3. Tsai (Ex. 1020)

Tsai describes a near-infrared optical filter having alternating layers of "low refractive index amorphous silicon nitride and high refractive index amorphous silicon," with the layers deposited by plasma-enhanced chemical

vapor deposition. Ex. 1020, code (57). Figure 10 of Tsai is reproduced below.

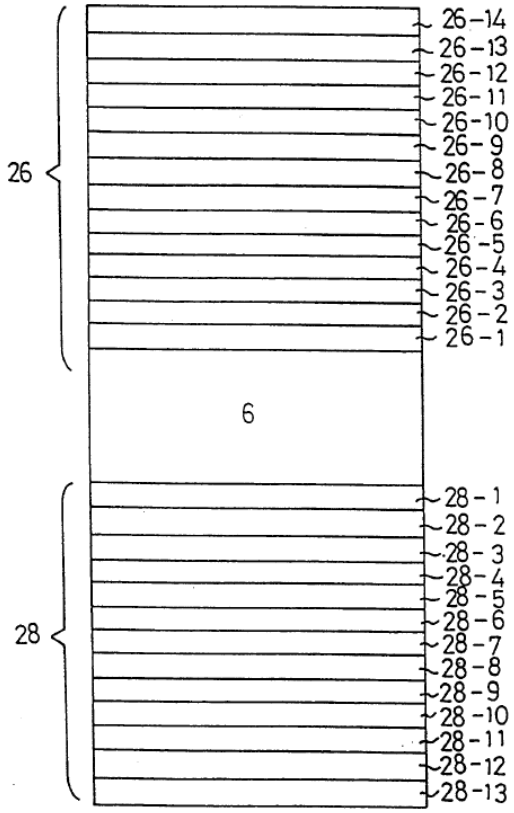

FIG.10

Figure 10 shows a cross-section of a near-infrared narrow band-pass filter. *Id.* at 2:47–48. The filter includes high-pass filter 26 and low-pass filter 28 deposited on opposite sides of glass substrate 6. *Id.* at 5:30–39. The narrow band-pass filter is achieved by "deposit[ing] alternate layers of amorphous silicon (a-Si:H) and amorphous silicon nitride (a-SiNx:H) on a Corning 7059 glass plate or a quartz plate." *Id.* at 1:63–66, 4:7–25, 5:36–60.

Figure 12 of Tsai is reproduced below.

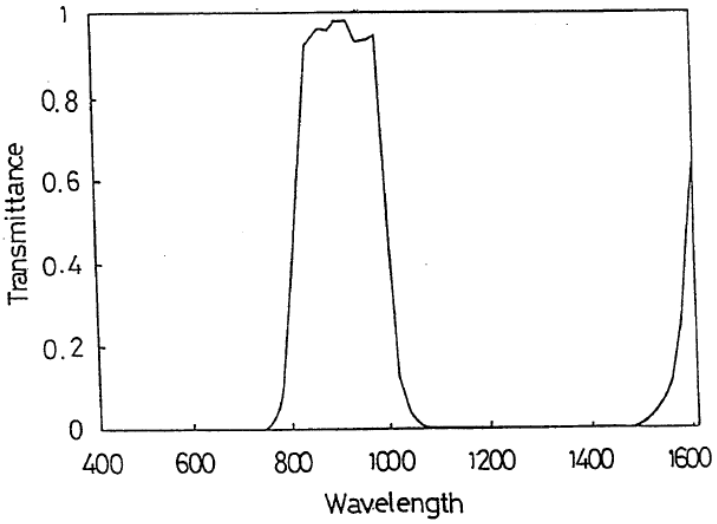

FIG.12

Figure 12 shows the transmittance curve of the narrow-bandpass filter, notably for which "[t]he transmittance in the 800–1000 nm range is peaked at 99.23% and has a bandwidth of 185 nm with a nearly rectangular shape." *Id.* at 6:2–5.

One filter described in Tsai includes an anti-reflection coating, as seen in Figure 7, reproduced below.

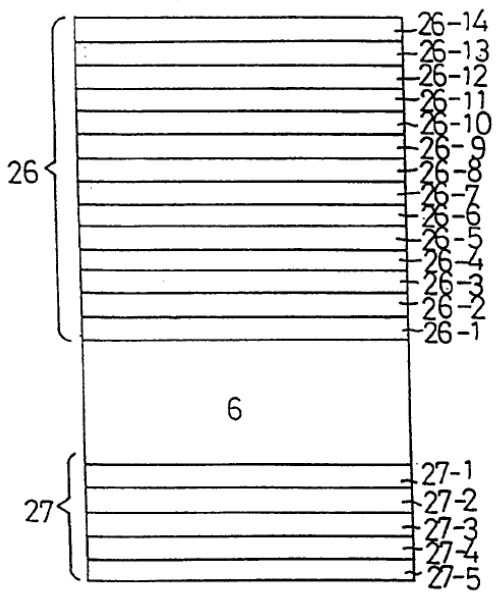

FIG.7

Figure 7 shows the cross-section of a substrate with a 14-layer edge filter on one side and a five-layer anti-reflection coating on the other. *Id.* at 2:34–35, 2:40–42. Tsai notes that this coating is applied "[f]or the improvement of transmittance in the near-infrared signals and the avoidance of loss due to reflection at the uncoated side of the substrate." *Id.* at 4:60–62.

4. Bamji (Ex. 1026)

Bamji describes a three-dimensional imaging system with an array of light sensing detectors, dedicated electronics, and associated processing circuitry. Ex. 1026, code (57). Bamji further teaches a lens with an associated filter to ensure that "only incoming light hav[ing] the wavelength emitted by [a] light source [] falls upon the detector array unattenuated." *Id.* at 5:60–64.

5. Claim 1

With respect to the recitations of claim 1 regarding an optical device and a near infrared band pass filter, Petitioner argues that Lairson discloses an optical device, which is "suitable for" bandpass filters, and includes a substrate having a first side and a second side. Pet. 30–32 (citing Ex. 1018, 1, 2, 5 ("We have demonstrated a high index materials system which is suitable for bandpass filters in the near infrared."); Ex. 1002 ¶ 134). Petitioner additionally argues that Erdogan also discloses an optical device that is a near infrared bandpass filter comprising a two-sided substrate. *Id.* (citing Ex. 1019, 1:18–21, 1:35–39, 2:42–47, 2:54–57, 5:18–20, Fig. 3; Ex. 1002 ¶¶ 135, 139–140). Petitioner asserts that Tsai additionally discloses such an optical device. *Id.* (citing Ex. 1020, 1:55–62, 5:30–42, 6:1–7, Fig. 10; Ex. 1002 ¶¶ 136, 141).

With respect to the substrate and layers recited in claim 1, Petitioner argues that Lairson describes a "short wave pass stack" including one comprising 44 layers, in which hydrogenated silicon layers are alternated with layers including silicon dioxide, which includes oxygen. Pet. 32–33 (citing Ex. 1018, 1; Ex. 1002 ¶ 148), 34 (citing Ex. 1018, 1; Ex. 1002 ¶ 151). Petitioner additionally argues that a combination of Lairson with either Erdogan or Tsai teaches such a short wave pass stack on one side of a substrate and a second, long-wave pass stack on the opposite side of the substrate to form a bandpass filter. *Id.* at 33 (citing Ex. 1019, 5:37–41; Ex. 1020, 5:30–33; Ex. 1024, 257–258; Ex. 1002 ¶¶ 138, 158). Thus, Petitioner argues, the combination of Lairson with either Erdogan or Tsai teaches or suggests the recited first set of layers on the first side including silicon and hydrogen. *Id.* at 33–34. Petitioner contends that while Lairson only describes layers of a short-pass filter, one of ordinary skill would have

known to form a bandpass filter by depositing a long-pass filter on the other side of the substrate, based on the teachings of Erdogan or Tsai. *Id.* at 34–38 (citing Ex. 1002 ¶¶ 32–36, 152–154, 157–162). Additionally, Petitioner contends that combining the teachings of Erdogan and Tsai in this manner would have required only routine skill, and that one of ordinary skill in the art would have reasonably expected success in making the combination. *Id.* at 38–39 (citing Ex. 1002 ¶¶ 32–36, 158–159, 162).

Petitioner additionally argues that the combination of Lairson with Erdogan or Tsai teaches a third set of layers on the second side of the substrate, and that these layers would have been made with the same materials used on each side of the substrate, including SiO_2, as on the first side of the substrate in Lairson. Pet. 34–35. As discussed above, Section II.C.1, Petitioner and Patent Owner present alternate claim construction arguments, but each agrees that the limitation encompasses a third set of layers including oxygen, as SiO_2 does.

Patent Owner does not dispute any application of the individual teachings of Lairson, Erdogan, or Tsai in Petitioner's asserted grounds, but argues that one of ordinary skill would not have sought to combine Lairson with Erdogan or Tsai. PO Resp. 45–48; PO Sur-reply 18–19. Patent Owner contends that Lairson only discloses short-wave pass edge filter designs, and that while Lairson also "states that a bandpass filter was fabricated from high-refractive index materials" and discusses the performance of that filter, Lairson does not disclose how the bandpass filter was designed. PO Resp. 45 (citing Ex. 2001 ¶ 86). Patent Owner further argues that Erdogan is used by Petitioner to show how bandpass filters could be fabricated from short- and long-wave-pass filter stacks formed on opposite sides of the substrate, but that one of ordinary skill in the art would not have used Lairson's thin

film stack of hydrogenated silicon and silicon dioxide, relied upon by Petitioner. *Id.* at 46–48 (citing Ex. 2001 ¶¶ 88–91); PO Sur-reply 18–19.

Table 1 of Lairson, reproduced below, "lists the angle shift and polarization splitting for simple 44-layer quarter wave stacks."

Materials	**Thickness (nm)**	**s-p shift**	**Angle Shift (48°–42°)**	**Index Ratio**
(Nb2O5-SiO2)×22	12546	69nm	-60nm	1.6
(SiH-SiO2)×22	11178	78nm	-17nm	2.3
(SiH-SiN)×22	9073	32nm	-11nm	1.6

Ex. 1018, 1. This table describes 44-layer stacks including hydrogenated silicon and silicon dioxide ("SiH-SiO2") and including hydrogenated silicon and silicon nitride combination ("SiH-SiN").

Patent Owner admits that "Lairson shows transmission spectra for a specific bandpass filter fabricated from hydrogenated silicon and silicon dioxide" in Lairson's Figure 4, but argues that "Lairson does not suggest that this combination of high and low refractive index materials would be better than" the hydrogenated silicon and silicon nitride combination (SiH-SiN) shown in Table 1 to have "significantly better angle shift and s and p splitting." PO Resp. 47. Because "Lairson does not limit the materials that could be used by a POSA to make the filter stacks for the [Lairson / Erdogan] combination," Patent Owner argues that a POSA would not select Lairson's "inferior multilayers" of hydrogenated silicon and silicon dioxide in the combination, but would only have based a design on a stack of hydrogenated silicon and silicon nitride. *Id.* at 47–48 (citing Ex. 2001 ¶¶ 89, 91); *id.* at 48 (citing Ex. 2001 ¶¶ 93–95; making the same argument for the Lairson and Tsai combination). Patent Owner essentially argues that Lairson teaches away from the asserted combinations in which Lairson's

hydrogenated silicon and silicon dioxide are used for a short-pass filter. PO Resp. 3, 46–48.

For a reference to "teach away," the reference must actually "criticize, discredit, or otherwise discourage" investigation into the claimed solution. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). A reference does not "teach away" if it merely expresses a general preference for an alternative invention from amongst options available to the ordinarily skilled artisan, and the reference does not discredit or discourage investigation into the invention claimed. *Id.* "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

Patent Owner argues that Lairson offers a specific alternative (hydrogenated silicon and silicon nitride combination) with improved properties, which are "significant teachings away" from the use of hydrogenated silicon and silicon dioxide. PO Sur-reply 18–19. But Patent Owner's declarant agrees that Lairson discloses that "the bandpass filter the Lairson authors actually made used hydrogenated silicon and silicon dioxide materials." Ex. 2001 ¶ 89. While Patent Owner argues this was done to show better performance of such layers over layers of niobia and silica, Patent Owner contends that because Lairson established that layers of hydrogenated silicon and silicon nitride would provide better performance,

hydrogenated silicon and silicon dioxide would be "inferior" and would not have been selected by one of ordinary skill in the art. PO Resp. 47–48; PO Sur-reply 18–19.

We determine that, upon considering Lairson, one of ordinary skill in the art would not have been discouraged from following the path set forth in the reference, which actually describes a specific bandpass filter fabricated from hydrogenated silicon and silicon dioxide. Pet. Reply 13–14 (citing PO Resp. 74; Ex. 1051, 107:11–24, 115:15–116:2). Specifically, the evidence does not show how Lairson discredits the bandpass filter that it teaches was created and tested. Ex. 1018, 10–11; PO Resp. 47. Rather, Lairson describes the performance of various materials for short-wave pass stacks. Even assuming that one of ordinary skill would have found the hydrogenated silicon and silicon nitride combination to have the best performance and excluding, for the moment, consideration of the portions of Lairson describing the use of silicon dioxide in a created and tested bandpass filter, we find that Table 1 and the associated disclosure provides no more than an expression of a general preference for the use of those materials, as opposed to discouraging one of ordinary skill from the use of hydrogenated silicon with silicon dioxide. Ex. 1002 ¶ 151. In light of this, we determine an ordinarily skilled artisan, upon looking at Lairson, would have been motivated to use a specific bandpass filter fabricated from hydrogenated silicon and silicon dioxide. Nothing in Lairson rises to the level of criticizing, discrediting, or otherwise discouraging Patent Owner's proposed combination of Lairson with Erdogan or Tsai.

We have examined each of Petitioner's citations to Lairson and Erdogan and determine that these references, in the cited portions, teach or suggest the argued element of the claim, as per Petitioner's assertions.

Ex. 1018, 1, 2, 5; Ex. 1019, 1:18–21, 1:35–39, 2:42–47, 2:54–57, 5:18–20, 5:37–41, Fig. 3.

Additionally, we have examined Petitioner's contentions and evidence regarding the combination of Lairson and Erdogan, and, in addition to finding no teaching away (as discussed above) we find a motivation to combine and find the evidence supports Petitioner's uncontroverted contention that the combination required only routine skill, and that one of ordinary skill in the art would have reasonably expected success in making the combination. *See, e.g.*, Ex. 1002 ¶¶ 32–36, 158–159, 162. We have examined the cited expert testimony and Petitioner's citations to Lairson and Tsai and determine that these Lairson and Tsai, in the cited portions, teach or suggest the argued element of the claim, and that there is persuasive evidence regarding a motivation to combine and regarding the teaching of the combination, as per Petitioner's assertions. Ex. 1018, 1, 2, 5; Ex. 1020, 1:55–62, 5:30–42, 6:1–7, Fig. 10; Ex. 1002 ¶¶ 154, 158, 159.

For the reasons discussed above, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson and Erdogan would have rendered claim 1 obvious. Accordingly, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson and Tsai would have rendered claim 1 obvious.

6. Claims 2, 3, and 6

Claims 2 and 3 depend from claim 1 and further recite that "one or both of the second set or the third set of layers includes silicon" (claim 2, Ex. 1001, 10:50–51) or that "one or both of the second set or the third set of layers is silicon dioxide" (claim 3, Ex. 1001, 10:52–53). For both of these claims, Petitioner cites Lairson's disclosure of using SiO_2 as a second set of

layers in forming a short-pass filter on the first side of the substrate. Pet. 35 (citing Ex. 1018, 1; Ex. 1002 ¶ 155).

Claim 6 depends from claim 1 and further requires that the "total quantity of layers on the first side is between 25 and 48." Ex. 1001, 10:58–59. Petitioner cites Lairson's disclosure of 44-layer stacks. Pet. 36 (citing Ex. 1018, 1; Ex. 1002 ¶ 156).

Patent Owner presents no additional arguments regarding these contentions.

The 44-layer stack of Lairson includes hydrogenated silicon alternating with SiO_2 and describes a stack of between 25 and 48 layers including silicon dioxide (and thus including silicon). Ex. 1018, 1. After considering the complete record, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson and Erdogan would have rendered claims 2, 3, and 6 obvious. Accordingly, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson and Tsai would have rendered claims 2, 3, and 6 obvious.

7. Claim 7

Petitioner argues that one of ordinary skill in the art would have used the combined teachings of Lairson and Erdogan or Lairson and Tsai to create a near infrared bandpass filter for Bamji's three-dimensional sensor system, which Petitioner contends would have included a NIR bandpass filter. Pet. 39–41 (citing, *inter alia*, Ex. 1026, 4:49–54, 5:62–64, 7:26–32; Ex. 1025, 184; Ex. 1043, 5561; Ex. 1018, 1; Ex. 1002 ¶¶ 43–50, 166). Petitioner further argues that one of ordinary skill "would have found it obvious to form Bamji's NIR [bandpass filter] with Lairson's materials . . . because it was a known material with favorable properties for use in the NIR

portion of the spectrum" and would have known to access and use "thin film design and simulation software" to create a filter for Bamji's system with a reasonable expectation of success. *Id.* at 40–41 (citing Ex. 1002 ¶¶ 32–36, 43–50, 166). Petitioner argues that these combinations teach or suggest the additional limitation of claim 7, i.e., that the optical device is configured for use in a 3D image sensing system. *Id.* at 39–41.

Patent Owner reiterates its arguments against the combination the combination of Lairson with either Erdogan or Tsai, addressed above. PO Resp. 48–49, 50–51. Additionally, Patent Owner argues that Petitioner does not show why one of ordinary skill would have designed a new filter for Bamji's system or show that a suitable optical filter for Bamji's system was not available in the prior art. *Id.* at 49–50 (citing Ex. 2001 ¶ 99); PO Sur-reply 20–21. Because other filters, not made of hydrogenated silicon multilayers, were known to exist, Patent Owner argues that one of ordinary skill in the art would not have elected to design a new filter using Lairson and Erdogan or Tsai. PO Resp. 50–51 (citing Ex. 2001 ¶ 99).

Upon consideration of the record and arguments advanced in the Petition, we determine that one of ordinary skill in the art would have been motivated to make the proposed combination of Bamji with Lairson and Erdogan or Tsai. Patent Owner and its declarant argue that the record does not show what would have "informed a POSA that they would have needed to attempt to make a new filter" as opposed to using an existing NIR filter for a system such as Bamji. PO Resp. 49–50; Ex. 2001 ¶ 99. But Bamji does not identify any particular type of filter to use with its three-dimensional sensor system. As such, Dr. Rancourt provides persuasive testimony that an ordinarily skilled artisan would have known to implement a bandpass filter suitable to create a light source with Bamji's specified

emission range of 800 nm to 1100 nm. *See* Ex. 1002 ¶¶ 164–166; Ex. 1026, 7:24–33. And, even if Bamji identified a pre-existing filter or specified what filter to use, absent more, this would not discourage investigation into an alternative to such a filter. *See Meiresonne v. Google*, *Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) ("A reference that 'merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into' the claimed invention does not teach away.") (quoting *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)). And "that 'better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.'" *Bayer Pharma AG v. Watson Lab'ys, Inc.*, 874 F.3d 1316, 1327 (Fed. Cir. 2017) (quoting *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012)). Petitioner's reasons for using Lairson's materials to form an NIR bandpass filter suitable for Bamji's system – to use a known material with favorable properties – stand unrebutted. Pet. 40–41 (citing Ex. 1002 ¶¶ 43–50, 166; Ex. 1025, 184; Ex. 1043, 5561; Ex. 1018, 1).

After considering the complete record, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson, Erdogan, and Bamji would have rendered claim 7 obvious. Accordingly, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Lairson, Tsai, and Bamji would have rendered claim 7 obvious.

F. Yoda Grounds[10]

Petitioner argues that claims 1–3 and 6 would have been obvious over a combination of Yoda and Tsai. Pet. 42–51. Petitioner additionally argues that claim 7 would have been obvious over a combination of Yoda, Tsai, and Bamji. *Id.* at 51–52. Petitioner also argues that claim 8 would have been obvious over a combination of Yoda, Tsai, and Pilgrim. *Id.* at 53–55.

Patent Owner presents various arguments against these assertions. PO Resp. 51–64; PO Sur-reply 19–22.

1. Yoda

Yoda relates to the optical properties of bandpass filters comprising "*a*-Si:H/SiO_2 multilayer films fabricated by radio-frequency magnetron sputtering." Ex. 1022, 3548. Yoda explains "optical bandpass filters (BPFs)" are "formed from alternating multilayer films of two dielectric materials . . . with high-low refractive indices." *Id.*

According to Yoda, a bandpass filter pairing materials having a "high refractive-index contrast, which is defined as the high index of one material divided by the low index of another," allows for a reduction in the total number of layers of a multilayer optical filter. *Id.* Yoda teaches that "[t]wo such pairs of materials are hydrogenated amorphous silicon (*a*-Si:H) and silicon dioxide (SiO_2)." *Id.* Yoda further teaches that "*a*-Si:H/SiO_2 multilayer films have the major advantage that the total number of layers of the multilayer is almost half of that of Ta_2O_5/SiO_2 multilayer films." *Id.*

[10] The Petition includes grounds based on Pilgrim in combination with Yoda alone or in combination with other references for claims 9–11 and 13–19 (Pet. 55–67); these are addressed in Section G ("*Pilgrim Grounds*").

Figure 7 of Yoda, reproduced below, shows an optical BPF having hydrogenated amorphous silicon (α-Si:H)/silicon dioxide (SiO_2) alternating multilayers. *Id.* at 3548, 3551.

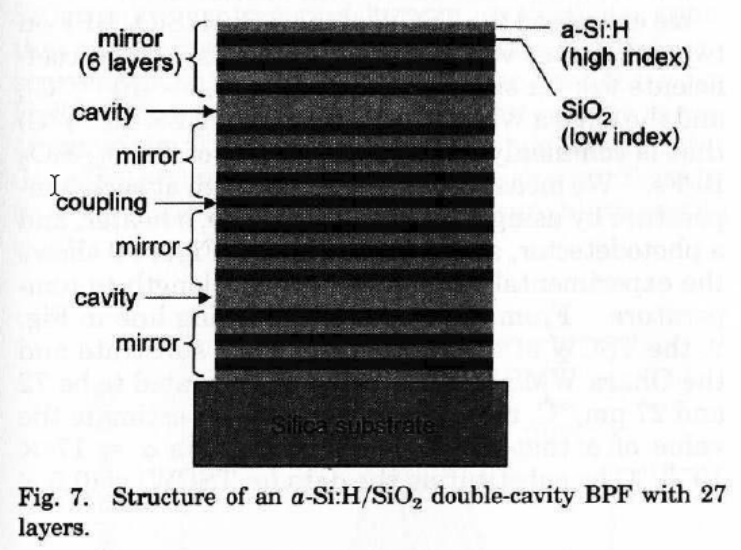

Fig. 7. Structure of an α-Si:H/SiO_2 double-cavity BPF with 27 layers.

Figure 7 shows an optical BPF having hydrogenated amorphous silicon (α-Si:H)/silicon dioxide (SiO_2) alternating multilayers. *Id.*

2. Pilgrim

Pilgrim relates to "[a] method and device for viewing objects situated in fog." Ex. 1021, code (57). "An optical system directs light from a scene onto a detector array through one or more optical waveband limiting filters." *Id.* According to Pilgrim, "[t]he pass band of the filter(s) reduces the amount of light scattered from the droplets of fog shifting the effective dynamic range of the lightest to the darkest portions of the image so that the detectors can provide detectible contrast between the objects being viewed compared with the background." *Id.* ¶ 13. "Multilayer bandpass filters are comprised of alternating layers of high and low refractive index materials" and the "number and thickness of these layers are selected to determine the wavelength of the pass band and the bandwidth." *Id.* ¶ 26.

Pilgrim teaches that, "[i]n the preferred embodiments, one or more bandpass filters are used to block all wavelengths of light except for those corresponding to the absorption bands of water." *Id.* ¶ 15. Moreover, "[i]n particular embodiments the filters can be comprised of multilayer coatings applied to flat optical surfaces." *Id.* ¶ 16. Pilgrim further teaches that, when using multilayer bandpass filters, the "band limits are chosen to ensure the shift in the pass band due to changes in the angle of incidence (AOI) does not result in the pass band being shifted out of the absorption band for which it is designed." *Id.*

Figure 3A of Pilgrim, reproduced below, illustrates the range of angles of incident light passing through multilayer pass band filter 300.

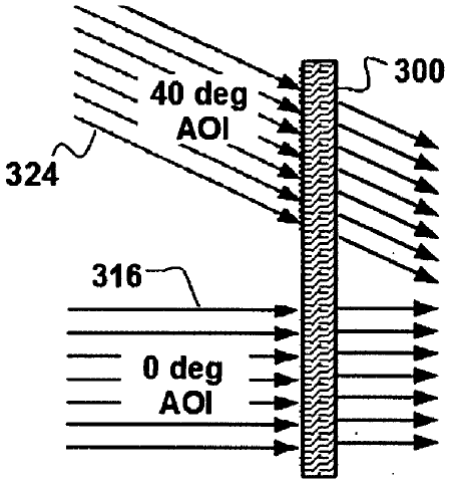

Figure 3A illustrates a multilayer bandpass filter with light passing through it normal to the surface of the filter and at an AOI of 40 degrees off of normal. *Id.* ¶ 6. Pilgrim teaches that "when incident light has an angle of incidence (AOI) of 0 (zero) degrees [shown in element] 316[,] the pass band is at its longest wavelength." *Id.* ¶ 25. And incident light having an "AOI of 40 degrees [element] 324, is at the limit of the field-of-view of a preferred embodiment." *Id.* Figure 3B, reproduced below, shows the "spectral effects of changes in the [AOI] of incoming light." *Id.* ¶ 26.

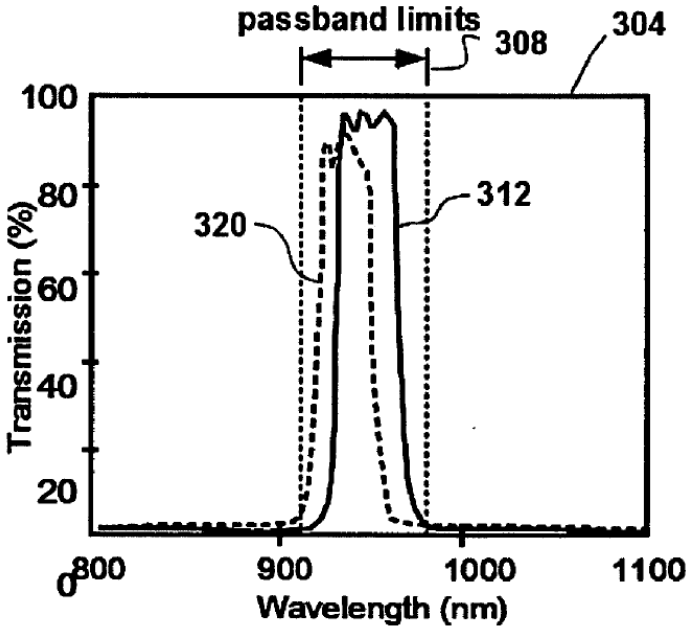

Figure 3B is a spectrogram showing spectral effects of changes in the light's incidence angle for an example in which the passband is centered on 950 nm with a full bandwidth of about ±25 nm. *Id.* ¶ 26. "The pass band for 0 degree AOI light 312 is designed to be far enough from the edges of the absorption pass band limits 308 that the shift in pass band at the widest AOI for the application (such as 40 degrees) 320 remains inside the pass band limits." *Id.* Here, Pilgrim states, "[t]he shift in pass band center between an AOI of 0 degrees and an AOI of 40 degrees is approximately 15 nm." *Id.*

3. Claim 1

Petitioner argues that Yoda teaches each limitation of claim 1, except for the last limitation ("a third set of layers on the second side, whether the third set of layers includes oxygen"), in its disclosure of a near infrared bandpass filter formed on one side of a substrate, including alternating layers of hydrogenated silicon and SiO_2. Pet. 42–46.

Petitioner argues that Yoda describes an optical device that is a near infrared bandpass filter. Pet. 42–43 (citing Ex. 1022, 3548, 3551; Ex. 1002 ¶¶ 169–172). Further, Petitioner argues that Yoda's filter includes a substrate with a first and second side. *Id.* at 43–44 (citing Ex. 1022, 3551; Ex. 1002 ¶ 174). Petitioner additionally argues that a first set of layers of Yoda's filter include silicon and hydrogen, and a second set includes oxygen. *Id.* at 44–46 (citing Ex. 1022, 3548, 3551; Ex. 1002 ¶¶ 177, 179).

For the last limitation of claim 1 ("a third set of layers on the second side, whether the third set of layers includes oxygen"), Petitioner acknowledges that Yoda does not disclose depositing layers on the second side of the substrate, but asserts that one of ordinary skill would have found it obvious, in view of Tsai, to apply an anti-reflective coating on the second side of the substrate. *Id.* at 46–47 (citing Ex. 1020, 4:5–5:15, Fig. 7; Ex. 1002 ¶¶ 180, 182). Petitioner asserts that this would improve transmittance. *Id.* at 47, 49 (citing Ex. 1020, 4:60–64, 5:21–27; Ex. 1002 ¶¶ 181, 183, 188). Petitioner further argues that it would have been obvious to use the same materials and deposition techniques as used in the filter stack in Yoda for the AR coating to "simplif[y] manufacturing," and that the oxide used in Yoda would therefore have been used in the AR coating on the second side of the substrate. *Id.* at 37, 47, 49–51 (citing Ex. 1002 ¶¶ 161, 180, 181, 187–191). Petitioner contends that the elements would combine in predictable ways and achieve predictable results, such as an expected benefit in transmittance. *Id.* at 49–51 (citing Ex. 1002 ¶¶ 189–191).

Patent Owner argues that the combination is "contrived by Petitioner solely in an attempt to show that individual limitations of the claims were known in the prior art and available to be assembled together in a single optical device." PO Resp. 51. Specifically, Patent Owner disputes

Petitioner's argument that the Tsai AR coating does not include oxygen, and argues Petitioner is using the claims as a guide in constructing a combination. *Id.* at 52–53 (citing Ex. 2001 ¶¶ 104–107). Patent Owner acknowledges Petitioner's provided reasoning for using the same materials on both sides of the substrate, to simplify manufacturing, but argues that Petitioner provides no evidence that using Yoda's materials for an AR coating would provide the benefits Tsai teaches for the AR coating materials Tsai uses, or that the simplification of manufacturing would "outweigh" the benefits of using Tsai's materials. *Id.* at 53 (citing Ex. 2001 ¶ 107). Patent Owner argues that one combining Yoda and Tsai would not have used Yoda's hydrogenated silicon and silicon dioxide, but would have used Tsai's hydrogenated silicon and hydrogenated silicon nitride. *Id.* at 53–54 (citing Ex. 2001 ¶ 108; Ex. 2003, 151:14–18).

Petitioner's declarant's testimony that the use of the same materials on both sides of the substrate would provide the benefits of simplifying manufacturing is uncontroverted. *See* Pet. 37, 50 (citing Ex. 1002 ¶¶ 161, 188 (discussing easier fabrication), 189 (asserting that the use of the same materials on both sides of the substrate would "make manufacturing more convenient, cheaper, and easier")). Patent Owner's declarant appears to acknowledge the benefit and provides, without citation to evidence or further explanation, testimony that "[i]n [his] opinion, a POSA's specific desire to obtain the benefits of using hydrogenated silicon and hydrogenated silicon nitride together, as informed by Yoda, would have outweighed any general desire to simplify the manufacturing process." Ex. 2001 ¶ 107. Patent Owner argues that Petitioner does not show that Petitioner's proposed AR coating overcomes issues identified in Tsai for other AR coatings. PO Resp. 53 (citing Ex. 2001 ¶ 106). But Patent Owner acknowledges that silicon

dioxide (as taught by Yoda for the second set of layers) could be used and was conventional for use in an AR coating (third set), and Petitioner presents in reply additional evidence, uncontroverted, regarding this use. PO Sur-reply 19–20; Pet. Reply 15–16 (citing Ex. 1001, 1:42–53 (background of the invention, describing a conventional blocking stack including silicon dioxide layers); Ex. 1051, 43:25–44:4).

With respect to Patent Owner's argument that Petitioner does not show why a Yoda/Tsai combination would not have used hydrogenated silicon and hydrogenated silicon nitride rather than hydrogenated silicon and silicon dioxide, again, the presence of a better alternative (assuming, now, that hydrogenated silicon and hydrogenated silicon nitride is the better alternative) does not render other possible combinations "inapt." *See Bayer Pharma AG*, 874 F.3d at 1327. On this record, as discussed immediately below, the evidence shows the benefits of using the same materials on both sides of a substrate would have motivated the use of Yoda's hydrogenated silicon and silicon dioxide for the purpose described in Tsai. Additionally, and contrary to Patent Owner's assertions, the record does not show any contravening reason why one of ordinary skill would not have made the combination.

We determine that Petitioner has shown that a preponderance of the evidence shows that the proposed combination of Yoda and Tsai teaches or suggests what is claimed in claim 1 and that one of ordinary skill would have been motivated to make the combination and would have had a reasonable expectation of success. Yoda describes a near infrared bandpass filter, including a substrate with a first and second side, a first set of layers including silicon and hydrogen, and a second set including oxygen. Ex. 1022, 3548, 3551; Ex. 1002 ¶¶ 169–172, 174, 177, 179. Combining

Tsai with Yoda to apply an AR coating on the second side of the substrate would have improved transmittance. Ex. 1020, 4:5–5:15, 5:21–27, Fig. 7; Ex. 1002 ¶¶ 180–183, 188. Using the deposition techniques and materials from Yoda for the AR coating also would have simplified manufacturing and achieved predictable results. Ex. 1020, 4:60–64, 5:21–27; Ex. 1002 ¶¶ 161, 180, 181, 183, 187–191. After considering the complete record, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Yoda and Tsai would have rendered claim 1 obvious.

4. Claims 2, 3, and 6

Petitioner argues that Yoda teaches the additional limitations of claims 2 and 3 in its multilayer stack with alternating layers of hydrogenated silicon and silicon dioxide. Pet. 47–48 (citing Ex. 1022, 3548, 3551; Ex. 1002 ¶ 183). Petitioner argues that the number of layers limitation of claim 6 (between 25 and 48) is taught by Yoda's teaching of a filter with 27 layers. *Id.* at 48 (citing Ex. 1022, 3551; Ex. 1002 ¶ 186).

Other than the arguments addressed above, Patent Owner does not present any arguments regarding these contentions. PO Resp. 52–55; PO Sur-reply 19–20.

We have examined each of Petitioner's citations and find that Yoda teaches the layer material limitations of claims 2 and 3 (Ex. 1022, 3548, 3551) and the numerical limitation on filter layers in claim 6 (*id.* at 3551). After considering the complete record, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Yoda and Tsai would have rendered claims 2, 3, and 6 obvious.

5. Claim 7

Petitioner argues that one of ordinary skill in the art would have used the combined teachings of Yoda and Tsai to create a near infrared filter for

Bamji's three-dimensional sensor system. Pet. 51–52 (citing Ex. 1002 ¶¶ 194, 195). In particular, Petitioner further argues that one of ordinary skill would have been motivated to use the layers described by Yoda and would have reasonably expected success in using Yoda and Tsai to produce a bandpass filter with an AR coating for Bamji's system. *Id.* at 52 (citing Ex. 1002 ¶ 195). Petitioner also argues that an ordinarily skilled artisan "would have been motivated to use Yoda's known filter materials for NIR BPFs to design both a suitable filter stack and an AR coating using conventional filter design techniques . . . and then using filter design software to optimize the design for Bamji's application." *Id.* at 51–52 (citing Ex. 1002 ¶ 194). As such, Petitioner argues that this combination teaches or suggests the additional limitation of claim 7, i.e., that the recited optical device is configured for use in a 3D image sensing system. *Id.* at 51–52.

Patent Owner argues that Bamji discloses a lens and filter combination but does not disclose the type of filter or the optical properties of the materials to be used for the filter. PO Resp. 49. Patent Owner argues that there is no evidence that one of ordinary skill would have designed and fabricated a new filter for Bamji because NIR for 3D imaging systems were known to exist. *Id.* at 49–50 (citing Ex. 1001, 1:42–53; Ex. 1021 ¶ 18; Ex. 2001 ¶ 99). Thus, Patent Owner contends, one of ordinary skill in the art would not have eschewed the off-the-shelf option in favor of designing and fabricating a different filter. *Id.* at 50; PO Sur-reply 20–21. Patent Owner additionally contends that Bamji's filter requires a different passband (within 800–1100 nm) than Yoda's bandpass filter (centered above 1500 nm) and that, despite assertions in the Petition that one of ordinary skill in the art could have used filter design software to develop a filter using Yoda's

materials and meeting Bamji's requirements, the Petition does not identify a working design for such a filter. PO Resp. 55–57 (citing Ex. 1022, Fig. 8; Ex. 2001 ¶¶ 114–115).

In reply, Petitioner emphasizes that Bamji relates to optical control in a near infrared range, and thus that Bamji required a NIR bandpass filter. Pet. Reply 16–17 (citing Ex. 1026, 4:49–54, 7:23–32; Ex. 1051, 25:4–21); *see also* Pet. 40–41, 51 (similar arguments). Petitioner additionally argues that the favorable properties of hydrogenated silicon and silicon dioxide "including ease of manufacture and customizable optical properties" would have motivated one of ordinary skill in the art to use them to manufacture a NIR filter. Pet. Reply 17–18 (citing, *inter alia*, Ex. 1025 (describing advantages of hydrogenated silicon in use with silicon dioxide in mirrors); Ex. 1043 (describing "excellent characteristics" of hydrogenated silicon in various applications)); *see also* Pet. 40–41, 52 (similar arguments). With respect to one of ordinary skill in the art using filter design software to develop a filter using hydrogenated silicon and silicon dioxide to meet the passband requirements of Bamji, Petitioner cites Patent Owner's declarant describing that one of ordinary skill in the art would have been able to use filter design software to design a NIR bandpass filter by adjusting the layer thickness and number of layers in the software. Pet. Reply 18 (citing Ex. 1051, 85:13–87:13 (describing that one of ordinary skill would be able to design a filter with desired properties with "amenable" materials using software programs or calculating the properties of a filter "from first principles" to find the best filter design that meets desired performance requirements)).

We determine that the record evidence shows that one of ordinary skill would have understood that Bamji's filter would be a NIR bandpass

filter and would have been motivated to design such a filter using Yoda's hydrogenated silicon and silicon dioxide, which are materials that would one of ordinary skill in the art would have had reason to select for the purpose. Ex. 1026, 7:26–32; Ex. 1051, 85:13–87:13; Ex. 1025; Ex. 1043; Ex. 1002 ¶¶ 193–195. Thus, we determine that the evidence shows that one of ordinary skill in the art would have been motivated to create a customized filter using hydrogenated silicon and silicon dioxide according to the proposed combination. *See* Ex. 1002 ¶¶ 193–195. Even if Patent Owner were correct that better off-the-shelf filters were available, the record evidence still establishes the obviousness of creating a customized filter using materials with known favorable properties as a workable—even if less preferred—option. *See Bayer Pharma AG*, 874 F.3d at 1327.

After considering the complete record, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Yoda, Tsai, and Bamji would have rendered claim 7 obvious.

6. Claim 8

Claim 8 requires that the optical device of claim 1 has a bandpass filter with a center wavelength that shifts less than 15 nm in magnitude with a change in incidence angle from 0 to 30 degrees. Ex. 1001, 10:62–64. Petitioner argues that Pilgrim teaches a system for imaging through fog including a NIR bandpass filter having a center wavelength that shifts approximately 15 nm over changes of incidence angle from 0 to 40 degrees, which would mean a shift of less than 15 nm over changes of incidence angle from 0 to 30 degrees. Pet. 53 (citing Ex. 1021 ¶¶ 16, 26; Ex. 1002 ¶¶ 200–201). Petitioner argues that, since Pilgrim discloses multilayer interference filters but does not teach what materials to use for the layers, one of ordinary skill in the art would have found it obvious to design a filter

for Pilgrim's application using Yoda's hydrogenated silicon and oxide materials and Tsai's AR coating. *Id.* at 53–55 (citing Ex. 1018,[11] 1; Ex. 1036, 1586; Ex. 1037, 42–56; Ex. 1047, 11:24–31; Ex. 1042, 329; Ex. 1022, 3548; Ex. 1018, 1; Ex. 1002 ¶¶ 202–206).

Patent Owner, in addition to arguments addressed above, argues that a filter resulting from the combination of Yoda and Tsai would provide a passband centered above 1500 nm, and that passband could not be used in Pilgrim's system, which requires a center wavelength of 950 nm.[12] PO Resp. 58–59 (citing Ex. 1022, Fig. 8; Ex. 1021, 1, Fig. 3b; Pet. 53 (asserting that Pilgrim's filter requires a passband centered at 950 nm); Ex. 2001 ¶¶ 119–120). Patent Owner additionally argues that Pilgrim does not require a multilayer interference filter, as Petitioner asserts, but rather would direct

[11] The reference on page 54 of the Petition to Exhibit 1019 appears to be a typographical error for Exhibit 1018.

[12] In reply, Petitioner argues that Pilgrim includes other "significant absorption bands" other than the 950 nm (925nm–975 nm) band cited by Petitioner in its Petition and that Pilgrim's 950 nm bandpass filter was only exemplary. Pet. Reply 19–21 (citing Ex. 1021 ¶¶ 15, 22, 24, Fig. 2; Ex. 1051, 117:5–123:5, 140:9–19). We determine that arguments based on these other absorption bands represent a new approach compared to the argument presented in the Petition, which specifically cited Pilgrim's NIR bandpass filter centered at 950 nm. Pet. 53 (referring specifically to Pilgrim as "includ[ing] a NIR [bandpass filter] with a passband centered at 950 nm"); *see* PO Sur-reply 21–22 (noting that Petitioner's arguments in the Petition related to a filter centered at 950 nm); Tr. 24:14–25:2 (Petitioner's counsel agreeing that "[Petitioner] did focus on the one [Pilgrim example with a band at 950 nm] because that is the example explicitly described in Pilgrim"). As such, we decline to consider arguments based on embodiments of Pilgrim other than the one (passband centered at 950 nm) specifically cited in the Petition. *See* Pet. Reply 20–21. Notwithstanding, Petitioner's initial analysis from the Petition persuasively shows obviousness, as discussed in this section.

one of ordinary skill towards neutral density or absorption filters. *Id.* at 59, 62 (citing Ex. 1021 ¶ 18, Fig. 3B; Ex. 2001 ¶¶ 123–124). Patent Owner contends that one of ordinary skill in the art would not have selected Yoda as a starting point for filter design because Yoda describes that its material has an absorption that increases (providing lower transmissivity of light) at lower wavelengths, while Pilgrim requires higher transmissivity. *Id.* at 60–61 (citing Ex. 1005, Fig. 4; Ex. 1004, Fig. 3B; Ex. 2001 ¶ 122).

We consider whether Petitioner has shown by a preponderance of the evidence that, as asserted in the Petition, one of ordinary skill in the art would have been motivated to use the teachings of Yoda and Tsai to create a multilayer interference filter for Pilgrim's system with a passband centered at 950 nm. *See* Pet. 53–55. We find that Petitioner has done so. As Petitioner alleges, Pilgrim discloses the use of a multilayer bandpass filter comprised of alternating layers of high and low refractive index materials. Ex. 1021 ¶¶ 25–26. Patent Owner's assertion that "Pilgrim places no limitations on the filter's structure or design [and] does not even require a multilayer interference filter, let alone suggest using the claimed material layers" (PO Resp. 56) does not contravene this. As discussed *supra*, Petitioner additionally shows that one of ordinary skill in the art would have been motivated to use the teachings of Yoda and Tsai to create such a multilayer bandpass filter. The record evidence additionally supports Petitioner's assertions that one of ordinary skill in the art would have selected hydrogenated silicon in order to achieve the required reduction in center wavelength shift. Pet. 3–4, 53–54; Ex. 1018, 1; Ex. 1036, 1586; Ex. 1037, 42–56; Ex. 1047, 11:24–31; Ex. 1002 ¶¶ 202–205. The record evidence further supports Petitioner's contentions that one of ordinary skill in the art would have expected reasonable success in using the combined

teachings of Yoda and Tsai to design a filter to achieve the requirements of Pilgrim with respect to center wavelength shift for a bandpass filter centered at 950 nm. Pet. 53–55 (citing Ex. 1002 ¶¶ 205–206); Ex. 1021 ¶ 26; Ex. 1051, 85:13–87:13, 135:6–18.

For these reasons and those previously addressed, Petitioner persuasively establishes by a preponderance of the evidence that the combination of Yoda, Tsai, and Pilgrim would have rendered claim 8 obvious.

G. Pilgrim Grounds

1. Claims 9–11

Claim 9 recites an optical device comprising a first set of layers including silicon and hydrogen and a second set of layers including oxygen, "wherein the optical device is a near infrared bandpass filter that has a center wavelength that shifts by less than 15 nm in magnitude with a change in incidence angle from 0° to 30°." Ex. 1001, 10:65–11:4. Claim 10 adds the requirement that the second set of layers includes silicon and claim 11 that the second set of layers is silicon dioxide. *Id.* at 11:5–8.

Petitioner argues that Pilgrim's optical device discloses a bandpass filter made up of high and low refractive index materials with the specified characteristics. Pet. 55–56 (citing Ex. 1021 ¶ 26; Ex. 1022, 3548, 3551; Ex. 1002 ¶¶ 200, 221). Petitioner, citing certain of its arguments relating to grounds including Yoda and Tsai, argues that one of ordinary skill in the art would have used Yoda's teachings of alternating layers of hydrogenated silicon and silicon dioxide to create a filter for Pilgrim, rendering claim 9 obvious. *Id.* Petitioner argues that the silicon dioxide in Yoda's second layers in the combination of Pilgrim and Yoda would teach using high n Si:H, and thus that one conventional selection for the second set of layers

(lower *n*) would have been silicon dioxide, thus teaching the additional recitation of claims 10 and 11. Pet. 57–59 (citing Ex. 1002 ¶¶ 222–225).

Patent Owner relies on substantially the same arguments as addressed above with respect to other grounds. PO Resp. 64–65; PO Sur-reply 21–22.

Petitioner has presented evidence that one of ordinary skill in the art would have been motivated to use the bandpass filter of Yoda to obtain a bandpass filter for Pilgrim's optical device, and would have reasonably expected success in doing so. Pilgrim describes a multilayer NIR bandpass filter with a wavelength that shifts by approximately 15 nm over angles of incidence from 0° to 40°. Ex. 1021 ¶¶ 13, 16, 26. Yoda teaches forming a bandpass filter using alternating layers of Si:H and oxide, and one of ordinary skill in the art would have found it obvious to use these materials to create the Pilgrim filter. Ex. 1002 ¶¶ 200–206, 221. Additionally, Petitioner shows that claims 10 and 11 would have been obvious given the use of silicon dioxide in the second layers of the resulting device. Ex. 1002 ¶¶ 222–225. Therefore, Petitioner persuasively establishes by a preponderance of the evidence that claims 9, 10, and 11 would have been obvious over Pilgrim and Yoda.

2. Claims 13 and 14

Claim 13 further limits the optical device of claim 9, requiring that "the near infrared band pass filter has a full width half maximum (FWHM) that is less than 50 nm." Ex. 1001, 11:11–13.

Petitioner shows that Pilgrim's passband has a FWHM of approximately 50 nm, because its full bandwidth is "approximately +/–25 nm," which would include instances of a FWHM that is less than 50 nm. Pet. 56–57 (citing Ex. 1021 ¶ 26; Ex. 1002 ¶ 216).

Claim 14 further limits the optical device of claim 9, requiring that "the passband shifts by less than 13 nm in magnitude with a change in incidence angle from 0° to 30°." Ex. 1001, 11:14–16.

Petitioner shows that the Pilgrim filter's center wavelength shifts by approximately 15 nm with a 40 degree change in incidence angle. Pet. 57. Petitioner additionally notes that angle of incidence effects are increasingly significant as the angle of incidence increases, and provides its declarant's testimony that the wavelength shift of Pilgrim's filter with a 30 degree change in incidence angle would have been less than 13 nm. *Id.* (citing Ex. 1002 ¶¶ 218–220). This declarant testimony is supported by additional evidence regarding the effect of the angle of incidence, in the form of an academic paper describing the effect of the angle of incidence on infrared filter characteristics. Ex. 1002 ¶ 219 (citing Ex. 1044,[13] 1344, 1347).

Patent Owner relies on arguments addressed above with respect to these claims. PO Reply 64–65; PO Sur-reply 21–22.

Upon consideration of the entire record, based on the showings described above, we find that Petitioner has shown by a preponderance of the evidence that claims 13 and 14 would have been obvious over a combination of Pilgrim and Yoda.

3. Claims 15–17

Petitioner argues that claims 15–17 would have been obvious over a combination of Pilgrim, Yoda, and Erdogan. Pet. 59–66. Claim 15 claims "[a]n optical system, comprising: a light source for emitting light having a wavelength between 800-1100 nm; and a filter comprising: a first set of

[13] M. L. Baker and L. V. Yen, Effects of the Variation of Angle of Incidence and Temperature on Infrared Filter Characteristics, Applied Optics, Vol. 6, No. 8, pp. 1343–51 (Aug. 1967).

layers including silicon and hydrogen; and a second set of layers including oxygen; wherein the filter is designed for substantially allowing light in a wavelength range that includes the wavelength between 800-1100 nm to pass through it and exhibits a blocking level greater than OD2 between 400 nm to 1100 nm but outside of the wavelength range." Ex. 1001, 11:17–12:5. Claim 16 depends from claim 15 and further requires that the "filter has a blocking level of greater than OD3 for wavelengths between 300 nm to 1100 nm that are outside of the wavelength range." *Id.* at 12:6–9. Claim 17 depends from claim 15 and further requires that "the filter has a center wavelength that shifts by less than 20 nm in magnitude with a change in incidence angle from 0° to 30°." *Id.* at 12:10–12.

For much of this combination, Petitioner argues that the optical system of the preamble of claim 15 is taught or suggested by Pilgrim's optical system and that the light source of claim 15 is taught in Pilgrim as well; with respect to the filter of claim 15, Petitioner argues that it is taught by the NIR bandpass filter of Pilgrim, designed using the materials taught in Yoda, with reference to its earlier arguments regarding combinations of Yoda and Tsai. *Id.* at 59–60 (citing Ex. 1021 ¶¶ 1, 15, 16, 19–21, 26, Fig. 1; Ex. 1002 ¶ 227). Petitioner provides evidence that the Pilgrim filter would substantially allow light in a wavelength range that includes the wavelength between 800 and 1100 nanometers, as it is centered on 950 nm. *Id.* at 60–61 (citing Ex. 1021 ¶ 26).

With respect to claim 15's recitation that the filter exhibits a blocking level greater than OD2 between 400 nm to 1100 nm but outside of the wavelength range, Petitioner argues that this is taught in Pilgrim's suggestion that it would seek all wavelengths outside of the passband. *Id.* at 61 (citing Ex. 1021 ¶¶ 14–15; Ex. 1002 ¶ 234). Petitioner additionally

describes Erdogan as teaching NIR bandpass filters with the required blocking levels expressed by OD / "figure of merit," which Petitioner argues would have been obvious to combine with Pilgrim's system because of Erdogan's teaching regarding wavelengths not of interest and Pilgrim's discussion of blocking out of band wavelengths. *Id.* at 61–62, 64–66 (citing Ex. 1019, 11:59–66, 12:17–20, 13:22–14:22; Ex. 1021 ¶¶ 14–15; Ex. 1002 ¶¶ 237–240, 246–249). Petitioner makes a similar argument with respect to the requirement of claim 16 that "the filter has a blocking level of greater than OD3 for wavelengths between 300 nm to 1100 nm that are outside of the wavelength range." *Id.* at 62–63. With respect to claim 17's requirement of a center wavelength shift of less than 20 nm, Petitioner relies on its arguments with respect to Pilgrim's teachings with respect to claim 8's recited shift of less than 15 nm (as opposed to claim 17's shift of less than 20 nm). *Id.* at 63.

Patent Owner relies only on arguments already addressed above with respect to these claims. PO Reply 64–65; PO Sur-reply 21–22.

Upon consideration of the entire record, based on the showings discussed above, we find that Petitioner has shown by a preponderance of the evidence that claims 15–17 would have been obvious over a combination of Pilgrim, Erdogan, and Yoda.

4. Claims 18 and 19

Petitioner argues claims 18 and 19 would have been obvious over Pilgrim, Erdogan, Yoda, and Tsai. Pet. 66–67. Petitioner's arguments refer to its arguments with respect to claims 1 (Yoda and Tsai combination), 8 (Yoda, Tsai, and Pilgrim combination), and 15 (Pilgrim, Erdogan, and Yoda combination). *Id.*

Patent Owner relies only on arguments already addressed above with respect to these claims. PO Reply 64–65; PO Sur-reply 21–22.

Upon consideration of the entire record, based on the showings discussed above, we find that Petitioner has shown by a preponderance of the evidence that claims 18 and 19 would have been obvious over a combination of Pilgrim, Erdogan, Yoda, and Tsai.

III. CONCLUSION[14]

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1–19	102	Hendrix	1–19	
1–3, 6	103	Lairson, Erdogan	1–3, 6	
1–3, 6	103	Lairson, Tsai	1–3, 6	
7	103	Lairson, Erdogan, Bamji	7	
7	103	Lairson, Tsai, Bamji	7	
1–3, 6	103	Yoda, Tsai	1–3, 6	
7	103	Yoda, Tsai, Bamji	7	
8	103	Yoda, Tsai, Pilgrim	8	
9–11, 13, 14	103	Pilgrim, Yoda	9–11, 13, 14	
15–17	103	Pilgrim, Erdogan, Yoda	15–17	

[14] 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).

18, 19	103	Pilgrim, Erdogan, Yoda, Tsai	18, 19	
Overall Outcome			1–19	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–19 of U.S. Patent No. 11,131,794 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PLATINUM OPTICS TECHNOLOGY, INC.,
Petitioner,

v.

VIAVI SOLUTIONS INC.,
Patent Owner.

IPR2022-01489
Patent 11,131,794 B2

FENICK, *Administrative Patent Judge*, *concurring*.

I join with the entire decision, except, respectfully, I do not join with Section II.D.1. There, I concur with the determination in the Majority Opinion ("Maj. Op.") that Hendrix qualifies as prior art, but not with certain portions of the analysis.

The Majority Opinion provides analysis of the claim construction of "layers including silicon and hydrogen" and related terms (*see* Maj. Op. 14 n.6) based on the assumption that "layers including silicon and hydrogen" only include "materials suitable for NIR bandpass filters, as suggested by Patent Owner." Maj. Op. 15. The Majority also limits the extrinsic evidence considered to "evidence of materials that are suitable for NIR filters," finding that "the extrinsic evidence of record supports a genus interpretation even when we exclude . . . unsuitable materials from our

analysis." *Id.* at 16–18 & n.7. I, however, continue to believe that Patent Owner's argument that the claimed "layers including silicon and hydrogen" must be interpreted to encompass only materials used to manufacture NIR bandpass filters is tautological, "as it defines the scope of materials disclosed for use in NIR bandpass filters as those which could successfully have been used to manufacture NIR bandpass filters." Inst. Dec. 32. This seems, to me, to allow for a construction that "merely recite[s] a description of the problem to be solved while claiming all solutions to it and . . . cover any compound later actually invented and determined to fall within the claim's functional boundaries—leaving it to . . . industry to complete an unfinished invention." *See Ariad*, 598 F.3d at 1353. Therefore, I would not perform an analysis using these assumptions.

I would, nevertheless, reach the same conclusion on the evidence and argument before us: that Hendrix qualifies as prior art to the '794 patent. My analysis largely would be the same as that in the Majority Opinion, with the exception of the Majority Opinion (1) concluding definitively that the disputed limitations are genus limitations, and (2) conducting an analysis based on the assumption that the scope of the disputed limitations is limited to materials usable for NIR bandpass filters.

Claim Construction

With respect to construction of "layers including silicon and hydrogen," upon examining the intrinsic evidence, I would find, as the Majority Opinion does, that the '794 patent specification does not contain language that generally describes layers including silicon and hydrogen, and in fact does not mention the two elements separately, except in the description of the system "used to produce the hydrogenated silicon

material" and the performance of the hydrogenated silicon material produced by that system. *See* Maj. Op. 15–16 (discussing Ex. 1001, code (57), 1:20–23, 2:57–3:19, 4:19–20, 4:35–5:61, 7:10–19). I agree that "the specification does not provide any indication of materials beyond hydrogenated silicon that are within the scope of 'layers including silicon and hydrogen.'" *Id.* at 16.

Patent Owner argues that the '794 patent specification supports materials other than "purely hydrogenated silicon" – namely hydrogenated silicon material that includes additional elements or compounds. PO Resp. 2, 41–43. I agree that the testimony of Patent Owner's declarant and Petitioner's declarant support a finding that hydrogenated silicon made according to the description in the specification could contain other elements or compounds. Ex. 1002 ¶ 121; Ex. 2001 ¶¶ 79–82; Ex. 2003, 55:12–56:7, 65:7–15, 84:18–85:22, 141:9–14, 142:1–4; Ex. 1051, 64:19–65:5. However, I would not consider this to support limiting the proper construction of "layers including silicon and hydrogen" to, for example, "hydrogenated silicon" or "hydrogenated silicon material that includes additional elements or compounds," despite our instruction that "the specification is 'always highly relevant to the claim construction analysis.'" *Phillips*, 415 F.3d at 1315 (citing *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)); *see* PO Resp. 43 (appearing to argue that "layers including silicon and hydrogen" are the hydrogenated silicon material described in the specification, which "could include additional elements or compounds"). Because of the facial breadth of the claim terms, I would not construe the disputed terms through the importation of a limitation (limiting the layers to hydrogenated silicon, with or without additional elements or compounds) from the specification into the claims. *See Phillips*, 415 F.3d at 1323 (noting

"the danger of reading limitations from the specification into the claim"); *see also Liebel–Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004) (noting that it is inappropriate to import limitations from the specification to limit facially broad claims "unless the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction'" (citations omitted)).

Regarding a possible broad interpretation of these limitations, Patent Owner contends that many layer materials including silicon and hydrogen would not be suitable for use in the claimed invention, and thus that the proper construction could not broadly include all such layers. PO Resp. 37–40 (discussing Ex. 1002 ¶¶ 124, 125, 128, 129; Ex. 2001 ¶¶ 67–72); PO Sur-reply 5–6, 13. But it is not required that a construction exclude all inoperative possibilities, and thus this argument against a broad construction is not compelling. *See Pharm. Res., Inc. v. Roxane Labs., Inc.*, 253 Fed. Appx. 26, 30 (Fed. Cir. 2007) (affirming a lower court's determination of broad scope even where inoperative combinations were encompassed in it); *see also Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750 F.2d 1569, 1576–77 (Fed. Cir. 1984) ("It is not a function of the claims to specifically exclude . . . possible inoperative substances." (quoting *In re Dinh-Nguyen*, 492 F.2d 856, 858–59 (CCPA 1974))).

Accordingly, I would find the disputed limitation to have a broad scope, encompassing layer materials other than hydrogenated silicon (with or without additional elements or compounds).

Written Description

For written description, the salient question "is whether the disclosure . . . reasonably conveys to those skilled in the art that the inventor had

possession of the claimed subject matter as of the filing date," *Ariad*, 598 F.3d at 1351. The specification does not support the broad construction I believe to be merited; it describes no layers other than hydrogenated silicon (pure or impure) having specific optical properties. *See Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 1479 (Fed. Cir. 1998) (concluding that a patentee's "original disclosure serves to limit the permissible breadth of . . . later-drafted claims"); *Cisco Systems, Inc. v. Cirrex Systems, LLC*, 856 F.3d 997, 1007–1008 (Fed. Cir. 2017) (describing *Gentry Gallery* as "expound[ing] upon the unremarkable proposition that a broad claim is invalid when the entirety of the specification clearly indicates that the invention is of a much narrower scope").

Furthermore, if the disputed limitations are interpreted as genus claim limitations, I stand in agreement with the Majority Opinion that there is no written description of a representative number of species or structural features that would support the genus (Maj. Op. 19–21), even though I do not join in the analysis with respect to the question of whether a functionally-defined genus could be supported (*id.* at 21–22) because, as discussed above, I believe such an interpretation is insupportable.

For these reasons, I would not find that the written description of Hendrix conveys possession of the subject matter claimed in the '794 patent claims.

Accordingly, I would determine, as the Majority Opinion does, that Hendrix qualifies as prior art to the '794 patent.

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