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Paper 10
Entered: January 25, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TRIENDA HOLDINGS, L.L.C.,
Petitioner,

v.

DESGAGNÉS, BROWN ET ASSOCIÉS INC.,
Patent Owner.

IPR2021-01295
Patent 10,570,276 B2

Before WESLEY B. DERRICK, JEFFREY W. ABRAHAM, and JAMES J. MAYBERRY, *Administrative Patent Judges.*

MAYBERRY, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background and Summary

Trienda Holdings, L.L.C., ("Petitioner"), filed a Petition ("Pet.") requesting *inter partes* review of claims 1–15 (the "Challenged Claims") of U.S. Patent No. 10,570,276 B2 (Ex. 1001, "the '276 patent"). Paper 1. Desgagné, Brown et Associés Inc. ("Patent Owner") filed a Preliminary Response ("Prelim. Resp.") to the Petition. Paper 7. With our authorization, Petitioner field a Preliminary Reply (Paper 8, "Prelim. Reply") and Patent Owner filed a Preliminary Sur-reply (Paper 9, "Prelim. Sur-reply").

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2021) (permitting the Board to institute trial on behalf of the Director). To institute an *inter partes* review, we must determine that the information presented in the Petition shows "a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). For the reasons set forth below, upon considering the present record, we institute an *inter partes* review.

B. Real Parties-in-Interest

Petitioner identifies itself and Penda Corporation, The Pendaform Company, Kruger Family Industries, LLC, and Kruger Family Holdings II, LLC as real parties-in-interest. Pet. 2.

Patent Owner states that it is the real party-in-interest. Paper 6, 2.

C. Related Matters

The parties identify, as a matter related to the '276 patent, ongoing litigation in the U.S. District Court for the Northern District of Oklahoma, in a case styled *Brown v. Kruger Family Holdings, II, LLC*, Case No. 4:20-cv-

00278-JFH-SH (N.D. Okla.). Pet. 2; Paper 6, 2. Patent Owner voluntarily dismissed its infringement claims of the '276 patent. Prelim. Resp. 14.

D. The '276 Patent

The '276 patent, titled "High Molecular Weight Polyethylene Composition, Product and Process of Making Same," issued February 25, 2020, from an application filed July 5, 2018. Ex. 1001, codes (22), (45), (54). The '276 patent is directed to a composition of matter, and products made from the composition, where the composition includes a blend of two virgin polyethylene resins with opposing rheological properties, two post-consumer polyethylene resins with opposing rheological properties, and a polyethylene antioxidant. *Id.* at 1:41–58. A post-consumer resin "is the recycled product of waste created by consumers whereas virgin resins are produced from fossil fuels." *Id.* at 1:15–17.

In an exemplary embodiment, one virgin polyethylene resin has high molecular weight, with a bimodal molecular weight distribution, and a molecular weight range of 100,000 to 500,000. Ex. 1001, 3:13–15. The other virgin polyethylene resin has a molecular weight range of 60,000 to 100,000. *Id.* at 3:16–17. The two virgin resins have a particle size distribution of from 1 to 50 μm. *Id.* at 2:56–59. "[T]he first and second virgin polyethylene resins are not required to be 'Prime Virgin' but may be wide-spec or off-grade." *Id.* at 2:47–49. The high molecular weight virgin resin has a high load melt index ("HMLI") from 1 to 6 grams/10 minutes, and the other virgin resin has an HMLI from 20 to 70 grams/10 minutes. *Id.* at 1:42–52.

In an exemplary embodiment, one "post-consumer polyethylene resin is a blow molding grade with a molecular weight distribution of 40,000 to 120,000," and the second post-consumer polyethylene resin has a molecular

weight between 80,000 and 500,000. Ex. 1001, 3:25–34. The first post-consumer polyethylene has a melt flow index ("MFI")[1] of less than 1 gram/10 minutes. *Id.* at 3:37–39. The second post-consumer polyethylene has a melt flow index from 4 to 8 grams/10 minutes. *Id.* at 1:55–56. Typically, these resins are provided as a 3/8-inch regrind. *Id.* at 45–46, 49–50.

The '276 patent discloses that an "[a]ntioxidant is required in polyethylene to stabilize and protect the polymer from oxidative degradation." Ex. 1001, 4:34–36.

E. Challenged Claims

The Petition challenges claims 1–15. Pet. 3. Independent claim 1 is representative.

> 1. A composition comprising:
>
> i) a first virgin polyethylene resin, having a bimodal molecular weight distribution which is high molecular weight (HMW), having a high load melt index measured according ASTM D-1238 (HLMI) of from about 1 to 6 g/10 min; and comprising a particle size distribution of less than about 50 μm;
>
> ii) a second virgin polyethylene resin, an HLMI from about 20-70 g/10 min, a melt flow index measured according ASTM D-1238 (MFI) of from about 0.20–0.60 g/10 min, and comprising a particle size distribution of less than about 50 μm;
>
> iii) a first post-consumer polyethylene resin, having a MFI of from about 0.10–0.70 g/10 min;
>
> iv) a second post-consumer polyethylene resin, which is HMW, and having a HLMI of from about 4–8 g/10 min; and
>
> v) a polyethylene antioxidant.

[1] The MFI is related to the HLMI by the flow rate ratio ("FRR"). FRR is equal to the HLMI divided by the MFI. *See* Ex. 1002 ¶ 76; Ex. 1003 ¶ 29. The MFI is also referred to as the melt index ("MI"). *See* Ex. 1003 ¶ 29; Ex. 1006 ¶ 31; Ex. 1002 ¶ 105.

Ex. 1001, 7:19–36. Independent claim 13 recites a polyethylene product that includes the composition as recited in claim 1. *Id.* at 8:21–39. Claim 15 recites a method for preparing a polyethylene product that includes, as the first step, "providing" the composition as recited in claim 1. *Id.* at 8:42–64.

F. Prior Art and Asserted Grounds

Petitioner asserts that the Challenged Claims are unpatentable based on two grounds:

Claims Challenged	35 U.S.C. §	References/Basis
1–15	103[2]	Harris[3], Nakayama[4]
1–15	103	Thomas[5], Starita[6], Nakayama

Petitioner relies on the declaration testimony of Dr. Chris Scott (Ex. 1002).

The following subsections provide brief descriptions of the asserted prior art references.

[2] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the '276 patent was issued on an application filed after this date, the AIA version of § 103 applies. *See* Ex. 1001, code (22).
[3] Harris, et al., US 2008/0114131 A1, published May 15, 2008 (Ex. 1003, "Harris").
[4] Nakayama et al., US 7,601,423 B2, issued October 13, 2009 (Ex. 1004, "Nakayama").
[5] Thomas et al., "Performance of Corrugated Pipe Manufactured with Recycled Polyethylene Content," NCHRP Report 696 (Transportation Research Board, 2011) (Ex. 1005, "Thomas").
[6] Starita, US 2005/0004316 A1, published January 6, 2005 (Ex. 1006, "Starita").

1. Harris (Ex. 1003)

Harris is titled "Polyethylene Melt Blends for High Density Polyethylene Applications." Ex. 1003, code (54). Harris is directed to "a melt-blended polyethylene composition that, when used in the manufacture of profile and corrugated pipe, pipe fittings, and the like, results in products that meet or exceed [American Association of State Highway Transportation Officials (AASHTO)] standards for density, MFI, flexural modulus, tensile strength and stress crack resistance." *Id.* ¶ 5. Harris discloses that an advantage of using its blend is that the composition can use "commodity grade resins, including virgin, recycled, scrap and wide specification resins . . . resulting in significant cost savings." *Id.* Harris discloses that

> regardless of the combination of resins employed, the resulting melt blended polyethylene composition has a density of about 0.945 to about 0.960 g/cm^3, preferably about 0.945 to about 0.955 g/cm^3 and, especially, 0.945 to 0.955 g/cm^3, a melt flow index of about 0.1 to about 0.4, preferably about 0.1 to 0.4, and a stress crack resistance of at least 24 hours.

Id. ¶ 6.

In general, Harris discloses that the resins used in its composition "can be unimodal, bimodal, multimodal, or mixtures of these types." Ex. 1003 ¶ 31. Also, "[a]ny or all of the" resins used in the "melt blended composition can be recycled, wide specification, scrap and/or virgin resin, with mixtures of these source resins being typical. In particular, the use of recycled, wide specification and/or scrap resins is very economical in comparison to the use of virgin resins." *Id.* ¶ 35. And, Harris discloses that different types of polyethylene may be used in a single blend (for example, up to six), "each having individual ranges of density, MFI and/or FRR and/or modalities . . . to increase the flexibility by which components can be

melt-blended together in order to achieve the desired physical characteristics of the resulting composition." *Id.* ¶ 38. Also, "[p]olyethylene resins suitable for use in the invention compositions can have a FRR of about 20 to about 200." *Id.* ¶ 29.

In one example, Harris discloses a melt-blend polyethylene composition that includes 40 percent homopolymer high density polyethylene ("H-HDPE"), 40 percent high molecular weight high density polyethylene ("HMW-HDPE"), and 20 percent linear low density polyethylene (LLLDPE). Ex. 1003 ¶¶ 53–56. The H-HDPE had a MFI of 0.8 and a density of 0.962 g/cm^3. *Id.* ¶ 52. The HMW-HDPE had a MFI of 0.044 and a density of 0.956 g/cm^3. *Id.*; *see also id.* at ¶¶ 33–34 (providing characteristics of HWM-HDPE and H-HDPE).

Harris discloses that, "[p]referably, pipes or pipe fittings comprising the melt blended composition are compounded with small amounts of carbon black, or other photo- and thermal-oxidation retarders to minimize the effects of heat and ultra violet light." Ex. 1003 ¶ 44.

2. Nakayama (Ex. 1004)

Nakayama is titled "Ethylene-based Polymer Microparticles, Functional Group-Containing Ethylene-based Polymer Microparticles, and Catalyst Carriers for Manufacture Thereof." Ex. 1004, code (54). Nakayama is directed to "microparticles . . . that have particle diameter smaller than that of conventional polyethylene fine-particles, no inter-particle agglomeration, very narrow particle size distribution, and high sphericity." *Id.*, code (57) (Abstract).

Nakayama discloses that, "[i]n recent years, polymer microparticles are actively developed and widely used for various industrial applications." Ex. 1004, 1:32–33. Also, "resin microparticles based on polyolefin,

especially polyethylene, attract attention due to the advantages of high crystallinity, high melting temperature, and increased chemical stability." *Id.* at 1:41–44. Nakayama notes that it was known that polyethylene-based microparticles with very narrow particle size distributions have "excellent flowability and bulk density" properties. *Id.* at 3:5–22.

Nakayama discloses polyethylene-based microparticles where at least 95 weight percent or more of particles pass through a mesh screen having an opening of 37 μm, and the median diameter is between 3 and 25 μm. Ex. 1004, 6:52–55; *see also id.* at 7:22–8:15 (discussing the particle size distribution and median particle size). Nakayama describes the method for making the disclosed microparticles. *See id.* at 12:64–22:5.

3. Thomas (Ex. 1005)

Thomas, titled "Performance of Corrugated Pipe Manufactured with Recycled Polyethylene Content," is a published report from the National Cooperative Highway Research Program, conducted by the Transportation Research Board. Ex. 1005, 1–2.[7] The report "provides potential specifications for corrugated drainage pipe manufactured with recycled high-density polyethylene," and "details the research performed and includes proposed draft specifications for recycled HDPE, formulations of virgin and recycled HDPE, and drainage pipe containing recycled HDPE." *Id.* at 5; *see also* Ex. 2002 ¶ 19 ("The purpose of this $350,000 project was to determine if recycled PE could be added to approved HDPE resins and still meet all the requirements of the [AASHTO] specification for HDPE Corrugated Pipe.")[8].

[7] We use the pagination provided by Petitioner for Exhibit 1005, rather than the document's pagination.
[8] Richard Thomas, Patent Owner's declarant (Exhibit 2002), is an author of Exhibit 1005. Ex. 2002 ¶¶ 10, 19.

Phase 2 of the research program focused on determining limits on the percentage of recycled material that can be blended with pipe resin and determining the relationships between the percentage of components in a blend and the blend's properties. Ex. 1005, 33–35; *see also id.* at 10–11 (summarizing the program), 12 (introducing the program), 13 (describing the program phases).

Relevant to this Decision, Thomas discloses that one sample used in Phase 2, labeled "B3," was formulated from a blend of four constituents: two virgin resins and two recycled resins. Ex. 1005, 42. B3 includes 20 percent of virgin resin number 1 ("VR1"), 40 percent of virgin linear medium-density polyethylene ("LMDPE"), 24 percent post-consumer recycled mixed-color resin ("PCR-MCR"), and 16 percent post-consumer recycled natural resin ("PCR-NAT"). *Id.* Thomas provides the short-term and long-term properties of the samples, including for B3. *Id.* at 41–55.

Thomas notes that bimodal HDPE resins could raise the performance of stress-crack resistance. Ex. 1005, 59.

4. Starita (Ex. 1006)

Starita is titled "Melt Blended High Density Polyethylene Compositions with Enhanced Properties and Method for Producing the Same." Ex. 1006, code (54). Starita is directed to "HDPE compositions and methods for formulating HDPE compositions that are melt blends of virgin, preprocessed, regrind and recycled HDPE and comply with the standards of AASHTO for corrugated polyethylene pipe[,] . . . includ[ing] specifications for density, melt flow index (MI), flexural modulus, tensile strength and environmental stress crack resistance." *Id.* ¶ 2.

Starita discloses that an "object of [the disclosed invention] blends commodity HDPE components that provide corrugated HDPE pipe

compositions having a density range of 0.945 to 0.955 grams per cubic centimeter and a MI of less than 0.4 with enhanced stress crack resistance and processing characteristics." Ex. 1006 ¶ 5. Also, Starita discloses "[s]pecific physical properties required to select both the high molecular weight and the low molecular weight HDPE components so that the number of loose ends associated with the short molecules are minimized and the physical properties of the blend composition meets the desired performance standards." *Id.* ¶ 6.

Relevant to this Decision, Starita discloses that one of the components of its blended composition is bimodal HWM-HDPE. Ex. 1006 ¶ 35. Starita discloses that "[e]nvironmental stress crack resistance of the bimodal HMW HDPE component . . . is increased as compared to the unimodal HMW HDPE component . . . having similar MI." *Id.*

II. PETITIONER'S STANDING TO FILE THIS PETITION

Patent Owner argues that, because Petitioner asserted in parallel district court litigation that it is the owner of the '276 patent, we should consider Petitioner as the owner of the '276 patent for standing purposes. Prelim. Resp. 14–15; *see* 35 U.S.C. § 311(a) (2013) ("Subject to the provisions of this chapter, a person who is not the owner of a patent may file with the Office a petition to institute an inter partes review of the patent."). Patent Owner argues that Petitioner's actions in district court amount to an admission that Petitioner lacks standing to file the Petition as owner of the patent. Prelim. Resp. 15.

Petitioner responds that it is not considered the owner of the '276 patent, as Petitioner is not the assignee of record. Prelim. Reply 1 (citing *Cardiovascular Sys., Inc. v. Cardio Flow, Inc.*, IPR2018-01658, Paper 7 at

2–3 (PTAB Mar. 8, 2019)). Petitioner argues that Patent Owner is the assignee of record and that Patent Owner had pled in the litigation that it was the sole owner of the '276 patent. *Id.* Petitioner adds that Patent Owner argued in the litigation that it had not assigned its ownership interest to Petitioner. *Id.*

Patent Owner replies that Petitioner should not be allowed to avail itself of *inter partes* review when it pursued the "false narrative" that it owned the patent. Prelim. Sur-reply 1. Patent Owner also distinguishes *Cardiovascular Sys.*, where the petitioner sought a declaration from the court that it owned the patent, unlike Petitioner, who represented to the court that Petitioner owned the '276 patent. *Id.*

We determine, on the current record, that Petitioner has standing to bring this proceeding. Here, as was the case in *Cardiovascular Sys.*, the record does not include any evidence that, at the time the Petition was filed, Petitioner actually owned the '276 patent. In fact, the parties do not dispute that Patent Owner is the current registered owner of the '276 patent, and was the owner when Petitioner filed the Petition. *See* Prelim. Reply 1; Prelim. Resp. 1. Notably, although Petitioner did assert ownership in the district court, Patent Owner disputed that assertion, claiming to be "the sole owner, by assignment, of all right, title and interest in and to the '276 [p]atent." Prelim. Reply 1 (quoting Ex. 1032 ¶ 55); *see also* Ex. 3001 (showing the assignment record for the '276 patent, indicating that Patent Owner is the recorded owner of the patent); 35 U.S.C. § 261 ("Applications for patent, patents, or any interest therein, shall be assignable in law by an instrument in writing."); 37 CFR § 3.73(a) ("The original applicant is presumed to be the owner of an application for an original patent, and any patent that may issue therefrom, unless there is an assignment."). Patent Owner does not direct us

to any evidence or argument that Patent Owner assigned its interest to Petitioner. To the contrary, Petitioner directs us to Patent Owner's argument in the district court proceeding that Patent Owner *did not assign* its interest to Petitioner. Prelim. Reply 1 (citing Ex. 1033, 9–15). The record evidence therefore indicates that Patent Owner is the owner of the '276 patent. Accordingly, because Petitioner is not the owner of the '276 patent, Petitioner has standing to file the Petition.

Patent Owner asks us, in the alternative, to exercise our discretion to deny the Petition. Prelim. Resp. 15. Patent Owner does not explain on what basis we would exercise this discretion, other than "based upon the undisputed factual circumstances detailed above." *Id.* Because Patent Owner fails to adequately develop this argument, we do not exercise discretion to deny the Petition.

III. ANALYSIS OF PETITIONER'S CHALLENGES

A. Applicable Law

Petitioner's asserted grounds of unpatentability are based on obviousness under 35 U.S.C. § 103.

> Section 103[] forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, objective evidence, such as

commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

"[O]bviousness must be determined in light of *all the facts*, and . . . a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine" teachings from multiple references. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (emphasis added); *see also PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014) ("The presence or absence of a motivation to combine references in an obviousness determination is a pure question of fact.").

"A prima facie case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art." *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003); *see also id.* at 1330 ("The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of . . . ranges is the optimum combination."). "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012) (citations omitted). "This rule is limited to cases in which the optimized variable is a 'result-effective variable.'" *Id.*; *see, e.g.*, *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980) ("[Discovery of an optimum value of a result effective variable . . . is ordinarily within the skill of the art."). "[T]he prior art need not provide the exact method of optimization for the variable to be result-effective. A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective." *In re Applied Materials*, 692 F.3d at 1297. "The mere fact that multiple result-effective

variables were combined does not necessarily render their combination beyond the capability of a person having ordinary skill in the art." *Id.* at 1298.

Notwithstanding what the teachings of the prior art would have suggested to one with ordinary skill in the art at the time of the patent's invention, the totality of the evidence submitted, including objective evidence of nonobviousness, may lead to a conclusion that the challenged claims would not have been obvious to one with ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984). Objective evidence of nonobviousness, so called "secondary considerations," may include long-felt but unsolved need, failure of others, unexpected results, commercial success, copying, licensing, and praise. *See Graham*, 383 U.S. at 17–18; *Leapfrog Enters., Inc. v. Fisher–Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007).

B. Level of Ordinary Skill in the Art

The level of skill in the art is "a prism or lens" through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Petitioner contends that a person having ordinary skill in the art would have possessed "a bachelor's degree in chemical engineering or mechanical engineering and three years of experience in blending polymer resins, or equivalent work experience." Pet. 16 (referencing Ex. 1002 ¶ 36). Dr. Scott does not further explain this characterization in his declaration. *See* Ex. 1002 ¶ 36.

Patent Owner disputes this contention. Prelim. Resp. 17. Patent Owner contends that the level of ordinary skill is "a bachelor's degree in chemistry or chemical engineering, and ten years' experience in polyethylene processing, formulating, and compounding or testing, thereof."

Id. at 16 (referencing Ex. 2002 ¶ 62). Patent Owner and Mr. Thomas dispute that a degreed mechanical engineer would have the requisite knowledge. Prelim. Resp. 17; Ex. 2002 ¶ 51. Patent Owner and Mr. Thomas also contend that greater, more focused, experience is required. Patent Owner and Mr. Thomas point to the complexities in blending more than two resins and the complexities in working with granular material. Prelim. Resp. 17–21; Ex. 2002 ¶¶ 57–61.

For the purposes of this Decision, based on the limited record before us, we preliminarily agree with aspects of both parties' characterizations, and disagree with other aspects. We focus on the experience aspect of Petitioner's characterization. Although we agree with Patent Owner that, in the abstract, a trained mechanical engineer may not have the requisite knowledge to be a person of ordinary skill and a chemist may have the requisite knowledge, Petitioner's characterization goes further, and requires three years of experience in blending polymer resins—the main technological aspect of not only the '276 patent, but of Harris, Thomas, and Starita. *See, e.g.*, Ex. 1001, 1:41–58 (disclosing that the composition is a blend of polymers); Ex. 1003, code (57) (stating that the disclosed composition is a melt blend of resins); Ex. 1005, 13 (indicating that Phase 2 is directed at blends of virgin and recycled resins); Ex. 1006, code (57) (indicating that it discloses melt blended HDPE).

As we will discuss in greater detail below, in connection with our claim construction analysis, and analysis of Patent Owner's arguments directed to the merits of Petitioner's obviousness positions, we do not agree with Patent Owner that the '276 patent requires extensive experience in working with granular resins. Also, Patent Owner and Mr. Thomas's distinctions based on what constitutes a polyethylene supplier and

polyethylene processor does not demonstrate, on the current record, that Petitioner's characterization of the required experience is deficient. *See* Prelim Resp. 17–19; Ex. 2002 ¶¶ 54–56. A person having ordinary skill in the art is a hypothetical person, not an actual person working at a specific type of facility. *See, e.g.*, *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) ("Obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art to which the patent pertains.").

Accordingly, based on our review of the current record, including the '276 patent and the prior art of record, we preliminarily determine that a person having ordinary skill in the art would have had a bachelor's degree in chemical engineering or related engineering field, or chemistry, and three years of experience in blending polymer resins.

We note that our Decision would not change if we applied Patent Owner's characterization, which reflects a higher level of ordinary skill.

C. Claim Construction

In *inter partes* reviews, we interpret a claim "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b). Under this standard, we construe the claim "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." *Id.*

1. Claim terms

a) "particle size distribution"

Petitioner contends that the term "particle size distribution" should be construed to mean "the primary particles created in the reactor, not the post-polymerization or pellet size." Pet. 18. Petitioner bases this construction on

the use of the term in the Specification, which references the term and discusses agglomerates, which are created in a reactor. *Id.* at 17–18.

Patent Owner contends that the term "particle size distribution" refers to the dried particles post-polymerization (that is the product of the reactor) and prior to any further processing, such as pelletizing." Prelim. Resp. 27. Patent Owner appears to take issue with the phrase "in the reactor," used by Petitioner. *See id.* Petitioner responds that Patent Owner's "post-polymerization arguments are a distinction without a difference. The primary particles in the reactor yield the dried post-polymerization particles. The particles would be effectively the same." Prelim. Reply 4.

We determine that we need not expressly construe this claim term to resolve the parties' disputes on the current record. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

b) Resin terms

Additionally, Patent Owner asks us to construe each of the four resin terms in the independent claims.

(1) Virgin resins

Claim 1 recites a composition that includes a first and a second virgin polyethylene resin.[9] Patent Owner contends that "a person of ordinary skill

[9] The virgin resin terms recite: "a first virgin polyethylene resin, having a bimodal molecular weight distribution which is high molecular weight (HMW), having a high load melt index measured according ASTM D-1238 (HLMI) of from about 1 to 6 g/10 min; and comprising a particle size distribution of less than about 50 μm;" and "a second virgin polyethylene resin, an HLMI from about 20–70 g/10 min, a melt flow index measured

in the art would understand the first virgin polyethylene resin is non-stabilized, thermoforming grade, wide-spec or off-grade granules, the granules having a particle size distribution less than 50 μm but may include some agglomerations greater than 50 μm." Prelim. Resp. 29 (referencing Ex. 2002 ¶ 91). Patent Owner argues that, because of the recited particle size, a person having ordinary skill in the art would know that the virgin resin is granular size particles and is "barefoot," i.e., not stabilized, and is a transitional product that is wide-spec or off-grade. *Id.* at 28 (referencing Ex. 1001, 2:47–55; Ex. 2002 ¶¶ 88–89).

Patent Owner provides a similar construction for the recited second virgin resin. Prelim. Resp. 29.

Petitioner responds that Patent Owner improperly imports limitations from the Specification and through extrinsic declaration evidence. Prelim. Reply 2–4. Patent Owner replies that Petitioner is asking the Board to ignore the understanding of a person having ordinary skill in the art. Prelim. Sur-reply 2–4.

On the current record, we agree with Petitioner that Patent Owner improperly imports limitations from the Specification into the claim. Before turning to the Specification, we first look to the words of the claims themselves. *See, e.g.*, *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) ("[T]he context in which a term is used in the [claim at issue] can be highly instructive."). The two virgin resin terms recite specific characteristics of the resins, such as HLMI, MFI, and particle size. The first virgin resin has a bimodal molecular weight distribution and is high

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according ASTM D-1238 (MFI) of from about 0.20–0.60 g/10 min, and comprising a particle size distribution of less than about 50 μm." Ex. 1001, 7:19–30.

molecular weight. None of these characteristics, in and of themselves, requires the resin to be "barefoot," or a transitional product that is wide-spec or off-grade. Nor does the particle size recitation require any specific form, such as a granular form.[10]

"[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Phillips*, 415 F.3d at 1315. The Specification does not support Patent Owner's position. For example, the Specification expressly states that the virgin resins are not required to be "Prime Virgin." Ex. 1001, 2:47–48. This language, however, contemplates that the resins could be "Prime Virgin." The next statement in the Specification strengthens this possibility—that the virgin resins "*may* be wide-spec or off-grade." *Id.* at 2:49 (emphasis added). That is, the resins are not required to be wide-spec or off-grade. Similarly, the Specification states that "[w]ide-spec resins *may* also be arising from a transitional processes." *Id.* at 2:51–52 (emphasis added). The Specification explains, by way of an *example*, "when moving from one grade of material to another at the reactor level and in the middle of the transition, 'granular' polyethylene is created that meets neither specification." *Id.* at 2:52–55. This disclosure demonstrates that the virgin resins may be wide-spec and the wide-spec may be transitional material, in granular form, but in no way requires such a form.

[10] Patent Owner includes a separate argument that we should not give weight to Petitioner's declarant's testimony, as it "does not even address granular material." Prelim. Resp. 55. As we preliminarily construe the resin terms to not require granular material, we do not find it significant that Petitioner's declarant does not address granular material.

The Specification merely recites particle size ranges for the first and second virgin resins. Ex. 1001, 2:56–3:12. The Specification does not limit the form of the resins, or tie the recited ranges to any form of material or any process. Like the claims, it unambiguously specifies particle size distributions without limiting or otherwise describing the form of the resins.

We are not directed to anything in the prosecution history that would support Patent Owner's constructions.

Given the unambiguous language of the claims, we need not turn to extrinsic evidence. We have reviewed Mr. Thomas's testimony, however, and do not find it sufficient to counter the intrinsic record. Mr. Thomas does not adequately support his opinion with evidence. *See* Ex. 2002, 86–91 (relying on disclosures in Exhibit 1001, which we discussed in evaluating the intrinsic evidence).

We determine, on the current record, that the virgin resin terms need no further construction, as the plain and ordinary meaning of the terms are clear from the language of the claims.

(2) Post-consumer resins

Claim 1 recites a first and second post-consumer polyethylene resin.[11] Patent Owner contends that the recited first post-consumer resin should be construed to mean "a recycled, extrusion or blow-molding grade, bottle or trash bag that is provided in a larger size than the first and second virgin polyethylene resin, either as a pellet, a flake or a regrind." Prelim. Resp. 31. Again, Patent Owner supports its construction by arguing that its

[11] Claim 1 recites: "a first post-consumer polyethylene resin, having a MFI of from about 0.10–0.70 g/10 min;" and "a second post-consumer polyethylene resin, which is HMW, and having a HLMI of from about 4–8 g/10 min." Ex. 1001, 7:31–34.

construction is how a person of ordinary skill in the art would understand the term. *Id.* at 30–31. Patent Owner has a similar construction and rationale for the construction of the second post-consumer resin.

Petitioner again argues that Patent Owner improperly imports limitations into the claim from the Specification, and Patent Owner responds that not doing so ignores how a person having ordinary skill in the art would understand the claims. Prelim. Reply 5; Prelim. Sur-reply 5. On the current record, we agree with Petitioner.

Again, the express claim language clearly recites the nature of the first and second post-consumer resins, in terms of MFI, HLMI, and molecular weight. Also, the Specification does not support Patent Owner's narrowing of the recited first and second post-consumer resins. The Specification describes post-consumer resins in exemplary terms. The Specification states that the first post-consumer polyethylene resin "*may* be obtained additionally, *for example*, from post-industrial blow molded bottles." Ex. 1001, 3:41–43 (emphasis added). The Specification adds that "*[t]ypically*, the resin may be provided as a 3/8" regrind." *Id.* at 3:45–46 (emphasis added). Similarly, for the second post-consumer resin, the Specification states that it "*may* be obtained, *for example*, from post-industrial barrels, trays, industrial pipe, and conduit ground. *Typically*, the resin may be provided as a 3/8" regrind." *Id.* at 3:47–50 (emphasis added). Words such as "may," "for example," and "typically," connote that, although the resins could have these characteristics, the characteristics are not required.

We are not directed to anything in the prosecution history that would support Patent Owner's constructions. We also do not find Mr. Thomas's

testimony to outweigh the intrinsic record, even if we were to consider extrinsic evidence.

We determine, on the current record, that the post-consumer resin terms need no further construction, as the plain and ordinary meaning of the terms are clear from the language of the claims.

c) Conclusion

We determine, on the current record, that no claim term needs to be expressly construed at this stage of the proceeding. Our claim construction analysis is preliminary at this stage of the proceeding, and the parties may further develop the record at trial to support their claim interpretations.

2. Result-effective variables

Petitioner contends that certain of the recited claim terms are result-effective variables. Pet. 19 (identifying (1) density; (2) molecular weight; (3) modality and molecular weight distribution; (4) melt flow; (5) particle size distribution; and (6) ratio of recycled to virgin content as result-effective variables). Patent Owner does not directly dispute Petitioner's contentions that these six terms are result-effective variables.

We have reviewed Petitioner's contentions and supporting evidence and determine, on the current record, that Petitioner adequately demonstrates, at this stage of the proceeding, that these six terms are result-effective variables. With respect to density, Petitioner contends that "[t]he prior art recognize[s] that increasing the density results in higher strength and stiffness but also lower ductility and increased processing difficulties." Pet. 20 (referencing Ex. 1007, 30–32; Ex. 1002 ¶¶ 66–67). Dr. Scott explains that "[i]t was well[]known . . . to create or select a resin having the desired density to result in the desired balance of strength, stiffness, and ductility." Ex. 1002 ¶ 67. Petitioner adds that "density of a resin can be

altered by changing the branching/crystallinity formed during polymerization." Pet. 20 (referencing Ex. 1007; Ex. 1002 ¶ 66).

With respect to molecular weight, Petitioner contends that the "prior art recognize[s] that higher molecular weight resins are more difficult and more expensive to process." Pet. 20 (referencing Ex. 1009, 1:21–43; Ex. 1003 ¶ 0034; Ex. 1002 ¶ 70). Dr. Scott explains that "increasing the molecular weight results in improved physical properties of a resin, such as environmental stress crack resistance, toughness, impact strength, and wear resistance. Higher molecular weight resins, however, are more difficult and expensive to process because melt-flow index varies inversely with molecular weight." Ex. 1002 ¶ 70 (referencing Ex. 1003 ¶ 0034); *see id.* ¶ 69 (referencing Ex. 1003 ¶¶ 2, 4, 5, 8 21, 23, 24, 25, 31, 34, Figs. 1–8)

With respect to modality and molecular weight distribution, Petitioner contends that the prior art demonstrates that "[v]arying the molecular weight distribution to attain multimodal resins, such as bimodal resins, which include LMW and HMW fractions, enhances the resins' physical properties while improving processability." Pet. 21 (Ex. 1011; Ex. 1002 ¶¶ 71–75); *see, e.g.*, Ex. 1006 ¶ 35 (disclosing that environmental stress crack resistance is increased for a bimodal HMW HDPE compound as compared to a HWM HDPE unimodal compound).

With respect to melt flow, Petitioner contends that the prior art demonstrates that changing the MFI and HLMI improve melt flow properties in a blended resin. Pet. 21 (referencing Ex. 1003 ¶¶ 0029–30; Ex. 1002 ¶ 77). Petitioner explains that "[l]ower HLMI or MFI indicates higher viscosity and higher molecular weight, improving certain mechanical properties of the end product but making it more difficult to process the resin, . . . [and h]igher HLMI or MFI indicates lower viscosity and lower

molecular weight, reducing certain mechanical properties while easing processability." *Id.* (referencing Ex. 1003 ¶ 0027; Ex. 1002 ¶ 78). Petitioner adds that "[c]hanging the resin's molecular weight during polymerization changes the resin's melt flow properties." *Id.* (referencing Ex. 1003 ¶ 0027; Ex. 1002 ¶ 78).

With respect to particle size distribution, Petitioner contends that the prior art demonstrates that "particle size used in a melt blend impacts the ease of homogenization and prevalence of defects when the resin is processed in the melt state." Pet. 22 (referencing Ex. 1010, 2:43–54, 4:54–67); *see* Ex. 1004, 3:5–22 (describing that the prior art recognized that polyethylene microparticles exhibit "excellent flowability and bulk density"); Ex. 1010, 2:43–54 (describing that particles with a mean particle density less than 300 μm are easier to homogenize during extrusion, resulting in less defects), 4:54–60 (describing that the smaller particle size results in improved homogeneity of the polyethylene polymer during extrusion). Petitioner adds that "[p]rimary particle size can be controlled by adjusting catalyst particle size and reactor residence time. *Id.* (referencing Ex. 1010, 2:25–39; Ex. 1002 ¶¶ 82–83).

With respect to ratio of recycled to virgin resin content, Petitioner contends that the prior art demonstrates that "the amount of recycled resin [in a blend] reduces the product's cost but has the potential to impair its quality and mechanical properties." Pet. 22 (referencing Ex. 1003 ¶¶ 0005, 0037). Petitioner adds that a person having ordinary skill in the art "knew to optimize the ratio of virgin to recycled resin to achieve the desired cost savings at tolerable reduction of these mechanical properties." *Id.* (referencing Ex. 1005, 24–28; Ex. 1003 ¶¶ 0005, 0037; Ex. 1002 ¶¶ 88–90).

D. Ground 1: Claims 1–15 as unpatentable over Harris and Nakayama

Petitioner contends that claims 1–15 are unpatentable as obvious over Harris and Nakayama. Pet. 4, 23–52. Below, we discuss the scope and content of the prior art and any differences between the prior art and claimed subject matter, on a limitation-by-limitation basis.

1. Independent claim 1

a) First virgin resin limitation

Claim 1 recites "a first virgin polyethylene resin, having a bimodal molecular weight distribution which is high molecular weight (HMW), having a high load melt index measured according [to] ASTM D-1238 (HLMI) of from about 1 to 6 g/10 min." Ex. 1001, 7:19–24 ("first virgin resin" limitation). Petitioner contends that Harris discloses an HMW-HDPE resin corresponding to the recited first virgin resin. Pet. 23 (referencing Ex. 1003 ¶ 35). Petitioner contends that the HWM-HDPE has a bimodal molecular weight distribution and has a high molecular weight. *Id.* at 23–24 (referencing Ex. 1003 ¶¶ 31, 33); *see also* Ex. 1003 ¶ 34 ("A suitable HMW-HDPE for use in the melt blends according to the invention has a weight average molecular weight of about 100,000 to about 1,000,000 daltons."). Harris's HMW-HDPE has an HLMI of 4.5 g/10 min., which is within the recited range of 1–6 g/10 min. Pet. 24 (referencing Ex. 1003 ¶ 29).

We have reviewed Petitioner's contentions and the supporting evidence and determine, on the current record, that Petitioner has sufficiently demonstrated that Harris discloses the subject matter of the first virgin resin limitation.

Patent Owner argues that Harris's broad disclosures, including disclosures of specific material and properties (such as HMW-HDPE and

modality), do not teach how to arrive at a specific combination of materials and material properties. Prelim. Resp. 44–47. We address this argument in Section III.D.1.h, below.

b) First virgin resin particle size distribution limitation

Claim 1 requires the first virgin polyethylene resin to "compris[e] a particle size distribution of less than about 50 μm." Ex. 1001, 7:24–25 ("first virgin resin particle size distribution" limitation). Petitioner contends that Nakayama discloses a polyethylene resin with a particle size distribution of less than 25 μm. Pet. 29 (referencing Ex. 1004, Abstract). Petitioner explains that Nakayama discloses that the particles have a narrow particle size distribution and that, in an exemplary embodiment, 100 percent of the particles are smaller than 37 μm. *Id.* (referencing Ex. 1004, 6:11–16, 7:22–37). Petitioner adds that Nakayama discloses that its particles are added to manufacturing equipment, such as in an extrusion process. *Id.* (referencing Ex. 1004, 7:38–59, 47:50–63).

We have reviewed Petitioner's contentions and the supporting evidence and determine, on the current record, that Petitioner has sufficiently demonstrated that Nakayama discloses the subject matter of the particle size distribution limitation. We discuss Petitioner's contentions with respect to motivation to combine, and Patent Owner's arguments against combining Nakayama with Harris, below, in Section III.D.1.g.

c) Second virgin resin and particle size limitations

Claim 1 also recites "a second virgin polyethylene resin, an HLMI from about 20-70 g/10 min, a melt flow index measured according [to] ASTM D-1238 (MFI) of from about 0.20-0.60 g/10 min, and comprising a particle size distribution of less than about 50 μm." Ex. 1001, 7:26–30

("second virgin resin" limitation). Petitioner contends that Harris discloses an H-HDPE resin corresponding to the recited second virgin resin. Pet. 24 (referencing Ex. 1003 ¶¶ 33, 35). Petitioner contends that Harris discloses that the H-HDPE resin has a MFI of 0.1–1.5 g/10 min. *Id.* (referencing Ex. 1003 ¶ 33). Petitioner explains that Harris discloses that its resins have an FRR ranging from 20 to 200, and Petitioner contends that this range "equates to an HMLI within the recited range of 20-70 g/10 min." *Id.* (referencing Ex. 1003 ¶ 29; Ex. 1002 ¶¶ 76, 132); *see* Ex. 1002 ¶ 132 (calculating a range of HMLI for the H-HDPE of 2–300, and preferably 9–195 g/10 min based on Harris's disclosed overall range (FRR=20-200) and Harris's preferred range (FRR=90–130)).

Petitioner relies on the same disclosure in Nakayama for the recited particle size distribution of the second virgin resin as for the first. *See* Pet. 29.

We have reviewed Petitioner's contentions and the supporting evidence and determine, on the current record, that Petitioner has sufficiently demonstrated that Harris discloses the subject matter of the second virgin resin limitation, to the extent that certain of the ranges disclosed in Harris overlap the recited ranges for HMLI and MLI.

Patent Owner does not directly dispute Petitioner's contentions with respect to the second virgin resin limitation. Patent Owner does dispute Petitioner's contentions with respect to obviousness and overlapping ranges, which we address below, in Section III.D.1.h. Also, Patent Owner disputes Petitioner's reliance on Nakayama, which we also discuss below, in Section III.D.1.g.

d) First and second post-consumer resin limitations

Claim 1 recites "a first post-consumer polyethylene resin, having a MFI of from about 0.10-0.70 g/10 min." Ex. 1001, 7:31–32 ("first post-consumer resin" limitation). Claim 1 also recites "a second post-consumer polyethylene resin, which is HMW, and having a HLMI of from about 4-8 g/10 min." *Id.* at 7:33–34 ("second post-consumer resin" limitation).

Petitioner contends that, based on Harris's teaching that its composition may include virgin or post-consumer resins, and the "well-known advantages of blending virgin with recycled resins, a person having ordinary skill in the art would have used a mixture of virgin and post-consumer recycled H-HDPE resins. Pet. 25–26 (referencing Ex. 1009 ¶ 9; Ex. 1002 ¶¶ 136–137, Ex. 1016, 12–14). Petitioner contends that the post-consumer resin would have "substantially similar" properties to the virgin H-HDPE, and the MFI for the resin would overlap the recited range. *Id.*

Similarly, Petitioner contends, based on the teachings in Harris, that a person having ordinary skill in the art would have used a mixture of virgin and post-consumer recycled HMW-HDPE resins, arriving at the recited second post-consumer resin. Pet. 26. Petitioner contends that the post-consumer resin would have "substantially similar" properties to the virgin HMW-HDPE, and the HLMI for the resin would be within the recited range. *Id.*

We have reviewed Petitioner's contentions and the supporting evidence and determine, on the current record, that Petitioner has sufficiently demonstrated that Harris discloses the subject matter of the first and second post-consumer resin limitations.

Patent Owner argues that Harris's general teachings, such as that the resin could be recycled or scrap products, does not teach how to arrive at a

specific combination of materials and material properties. Prelim. Resp. 44–47. We address this argument in Section III.D.1.h, below.

e) Antioxidant limitation

Finally, claim 1 recites "a polyethylene antioxidant." Ex. 1001, 7:36 ("antioxidant" limitation). Petitioner contends that Harris discloses a polyethylene antioxidant additive. Pet. 24, 26 (referencing Ex. 1003 ¶ 45–46; Ex. 1002 ¶ 143).

We have reviewed Petitioner's contentions and the supporting evidence and determine, on the current record, that Petitioner has sufficiently demonstrated that Harris discloses the subject matter of the antioxidant limitation. Patent Owner does not dispute Petitioner's contentions with respect to this limitation.

f) Additional Harris disclosure

Petitioner also relies on additional disclosures in Harris to support its contention. First, Petitioner directs us to Harris's Example 2, which Petitioner contends renders claim 1 obvious. Pet. 24. Harris's Example 2 discloses a composition that includes HMW-HDPE and H-HDPE. *Id.* at 25. Petitioner also directs us to Harris's disclosures on FRR, melt properties of HMW-HDPE and H-HDPE, and the use of virgin, recycled, scrap, and wide specification resins (and mixtures of these resins). *Id.* at 25–26. Petitioner contends that

> Based on the express disclosures in Harris's detailed description and Example 2, a [person having ordinary skill in the art] would immediately envisage the four-resin polyethylene composition containing an antioxidant having all of the claimed properties except the claimed particle size distribution, which is not explicitly disclosed in Harris. As a result, other than the particle size distribution limitations, no additional obviousness analysis for elements i–v is required.

Id. at 26 (referencing Ex. 1002 ¶ 114).

Petitioner adds that "based on Harris's disclosure and the extensive knowledge in the art of resin blending, a [person having ordinary skill in the art] would have found it obvious to create a four resin blend, as claimed, with a reasonable expectation of success." Pet. 26–27 (referencing Ex. 1002 ¶ 115; Ex. 1005, 43 (including sample B3)). Petitioner contends that Harris expressly teaches blends with up to six polyethylene resins. *Id.* at 27 (referencing Ex. 1003 ¶ 38).

Petitioner contends that a person having ordinary skill in the art would have selected a first virgin polyethylene resin that is bimodal, has a high molecular weight, and a low HLMI, for the enhanced mechanical properties of these resins. Pet. 27 (referencing Ex. 1002 ¶ 115). Petitioner adds that, given the low HLMI of the first virgin resin, a person having ordinary skill in the art would have combined that resin with a resin with higher HLMI and MFI to improve the processability of the composition. *Id.* (referencing Ex. 1002 ¶ 115). Petitioner continues that a person having ordinary skill in the art would have known to blend post-consumer resins with properties similar to the two virgin resins to reduce cost. *Id.* (referencing Ex. 1002 ¶ 116; Ex. 1003 ¶¶ 5, 37). Petitioner adds that it would have been obvious to add antioxidants, as they were commonly added to polyethylene. *Id.* at 28 (referencing Ex. 1003 ¶¶ 44–45; Ex. 1002 ¶ 117).

Petitioner continues that claimed ranges for HLMI and MFI would have been obvious because they are result-effective variables, and that the disclosures in Harris overlap with the claimed ranges. Pet. 28–29. We discuss Petitioner's contentions with respect to the obviousness of ranges, and Patent Owner's counter arguments, below, in Section III.D.1.h.

Petitioner explains that a person having ordinary skill in the art "would have had a reasonable expectation of success in replacing the single resins with resin blends because the resin properties can be adjusted by adjusting the proportions of each resin in the blend." Pet. 27–28 (referencing Ex. 1017 ¶¶ 0040–0068; Ex. 1002 ¶ 116).

We discuss in greater detail below Petitioner's contentions with respect to result-effective variables and overlapping ranges, and Patent Owner's counter arguments.

g) Reasons to combine Harris and Nakayama

Petitioner contends that a person having ordinary skill in the art would have had reason to modify the Harris resins based on Nakayama's teachings of microparticles to arrive at the recited particle size distribution for the first and second polyethylene virgin resins. Pet. 30–31. Petitioner contends that a person having ordinary skill in the art "would have selected microparticles to increase homogeneity without doing anything inventive." *Id.* at 30 (referencing Ex. 1002 ¶ 87). Petitioner explains that, "[b]ased on knowledge in the art related to particle size and resin blending," an artisan of ordinary skill "would have understood that it would have been desirable to minimize the resins' particle size to increase the ease of mixing and homogeneity, particularly in light of the high HLMI differences between the resins disclosed in Harris." *Id.* at 30–31 (referencing Ex. 1002 ¶ 87).

Patent Owner argues that "Nakayama teaches a specialized product for use as a 'high performance material.'" Prelim. Resp. 37. Patent Owner argues that Nakayama's particles are intended to remain as microparticles, have high sphericity, and do not agglomerate, making them "different from the granular transitional product of claim[] 1." *Id.* Patent Owner adds that Nakayama's particles are stabilized, not "barefoot." *Id.* Patent Owner also

argues that Nakayama's disclosure of specialized particles teaches away from a low cost composition. *Id.* at 38.

We have reviewed Patent Owner's arguments, but determine, on the current record, that Petitioner's arguments and evidence are sufficient, at this stage of the proceeding, to show that a person having ordinary skill would have had a reason to combine Nakayama's teachings of microparticles with Harris's resins. Petitioner provides express reasoning, with rational underpinning, grounded on increasing the ease of mixing and homogeneity as to why a person having ordinary skill in the art would look to Nakayama's teachings.

Also, as we will discuss in greater detail in the next subsection, Petitioner demonstrates, on the current record, that particle size distribution is a result-effective variable. If a claimed parameter is a result-effective variable, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Applied Materials*, 692 F.3d at 1295.

Finally, Patent Owner does not explain adequately how Harris or Nakayama disparages or otherwise teaches away from the proposed modification. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (holding that, to teach away, the prior art must "criticize, discredit, or otherwise discourage the solution claimed"); *see also In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) ("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."). Patent Owner does not direct us to any disclosure in Harris or Nakayama, or other

persuasive evidence, that criticizes, discredits, or otherwise discourages using virgin resins having a particle size range as taught in Nakayama.

Patent Owner enumerates eight arguments directed to the granular nature of the virgin resins. Prelim. Resp. 38–40. We have reviewed Patent Owner's arguments, but determine, on the current record, that Petitioner's argument and evidence is sufficient, at this stage of the proceeding, to show that a person having ordinary skill would have had a reason to combine Nakayama's teachings of microparticles with Harris's resins. As we discuss above, in connection with claim construction of the virgin polyethylene resins, we preliminarily construe the virgin resin terms not to require the resins to be wide-spec or off-grade granules.

h) Obviousness of overlapping ranges

Petitioner contends that the "claimed ranges for HLMI and MFI would have been obvious because they are result-effective variables." Pet. 28; *see id.* at 28–29 (comparing the disclosed ranges in Harris with the recited ranges). Petitioner states that "[a] '*prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art.'" Pet. 15 (citing *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003)); *see also id.* (citing *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018), and stating that, in such a situation, there is a "presumption of obviousness").

With respect to the recited particle size range, Petitioner contends that, "because particle size distribution is a result effective variable and because Nakayama's disclosed range overlaps with the claimed range, the claimed range is presumed obvious." Pet. 31.

Patent Owner argues that "[t]here are exceptions to the rule" governing the obviousness of overlapping ranges. Prelim. Resp. 35. These

exceptions are: "1) [t]he modification produces a new and unexpected result, such as a critical range; 2) [t]he prior art taught away from the claimed range; 3) [t]he parameter was not recognized as 'result-effective'; and 4) [d]isclosure of broad ranges do not invite routine optimization." *Id.* (citing *Synvina*, 904 F.3d at 1006). We address the two specific exceptions asserted by Patent Owner, below.

(1) Broad ranges

Patent Owner argues that, in *Synvina*, the Federal Circuit relied on a case where it held that a disclosure of 68,000 protein variants did not render the claimed subject matter obvious through routine optimization. Prelim. Resp. 35 (citing *Synvina*, 904 F.3d at 1006 (which discusses *Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc*., 655 F.3d 1291, 1306 (Fed. Cir. 2011))). Patent Owner also directs us to the Manual of Patent Examining Procedure, which requires "examiners to 'consider the size of the genus' when alleging obviousness." *Id.* (citing MPEP § 2144.08(II)(A)). Patent Owner also argues that the unpredictable nature of the art must be considered. *Id.* at 36 (citing *In re Sebek*, 465 F.2d 904, 907 (CCPA 1972), *Wyeth v. Abbott Laboratories*, 720 F.3d 1380, 1385 (Fed. Cir. 2013), *In re Stepan Company*, 868 F.3d 1342, 1347 (Fed. Cir. 2017)).

Patent Owner argues that, "[i]n the present case, the prior art discloses very broad ranges that suggest hundreds of thousands if not millions of candidate compositions and, because the technology becomes unpredictable in multi-polyethylene compositions, each candidate must [sic] composition must be made and then tested." Prelim. Resp. 36–37. Patent Owner argues that, in relying on Harris's general teachings, "Petitioner ignores the size of the genus and then ignores how unpredictable different polyethylene properties become as two or more different polyethylene resins are blended

together, and the number of properties a polyethylene resin composition has." *Id.* at 46 (referencing Ex. 2002 ¶ 134). Patent Owner and its expert calculates millions, and even billions, of possible compositions when combining multiple resins based on Harris's teachings. *Id.* at 46–47; *see* Ex. 2002 ¶¶ 134–138.

We have considered Patent Owner's arguments, but find that Petitioner's argument and evidence is sufficient, at this stage of the proceeding, to show that Harris discloses the claimed composition components as Petitioner contends, and that the disclosure does not represent an overly broad range of values for the optimized parameters. Patent Owner's reliance on a genus-species characterization of Harris's composition is misplaced. Harris does not disclose a broad genus from which Petitioner identifies a single species that corresponds to the subject matter of claim 1. Instead, Petitioner relies on teachings of specific types of polyethylene from Harris to arrive at a combination of HMW-HDPE and H-HDPE. Petitioner then relies on express teachings in Harris that recycled resins offer economic advantages over virgin resins, and the ability to combine a number of different constituents, to arrive at a four-resin composition. *See* Ex. 1003 ¶ 35; *see also id.* at ¶ 38 ("[I]t is possible to use combinations of resins that include, for example but not limited to, one to about 6 or more individual LLDPEs, LMDPEs, H-HDPEs, and/or HMW-HDPES."). On the current record, thus, we do not find that, out of millions or billions of possible compositions, Petitioner selected one that falls within the claims, to the exclusion of all others. And, contrary to Patent Owner's argument, a person having ordinary skill in the art would not be forced to test "hundreds of thousands if not millions of candidate compositions," as Harris provides a roadmap for arriving at the claimed composition. *See*

Prelim. Resp. 36; Pet. 23–28 (identifying express teachings in Harris); *see, e.g.*, Ex. 1003 ¶¶ 25, 31 (discussing modality and comparing results for unimodal and bimodal HWM-HDPE), 27–30 (discussing FRR and melt indexes), 32–34 (discussing express properties of H-HDPE and HMW-HDPE), 35 (using recycled resins), 38 (discussing blending multiple resins), 50–52, 57–60 (discussing examples, including Example 2)).

Also, the Federal Circuit instructs us that "[t]he mere fact that multiple result-effective variables were combined does not necessarily render their combination beyond the capability of a person having ordinary skill in the art." *In re Applied Materials*, 692 F.3d at 1298.

Patent Owner also argues that the unpredictable nature of the art weighs against Petitioner's obviousness positions. Prelim. Resp. 47–49. Patent Owner argues that its declarant demonstrated significant differences between modeled and actual performance results in compositions disclosed in Starita, demonstrating the unpredictable nature of these compounds. *Id.* at 48–49.

We have considered Patent Owner's argument, but find that there is not such unpredictability in the art that it undermines Petitioner's positions. Again, Patent Owner's argument seems to rely on the premise that Petitioner selected a single composition configuration from "the millions of combinations a" person having ordinary skill in the art "would have [had] to consider." Prelim. Resp. 49. As we discuss above, this argument ignores the roadmap provided by Harris for a composition with a combination of HMW-HDPE and H-HDPE, a combination that may include both virgin and recycled resins.

(2) Unexpected results

Patent Owner argues that the use of virgin resins with particle sizes less than 50 μm in the composition with recycled material provides "an unexpected and surprising result." Prelim. Resp. 42–44. Patent Owner explains that there is a tension between using high molecular weight resins and blow molding grade material, as the HWM material "attempts to draw down the melt in an aggressive manner." *Id.* at 42–43 (referencing Ex. 2001 ¶ 30). Patent Owner contends that using granular material "relax[es] the tension." *Id.* (referencing Ex. 2001 ¶ 30).

We have considered Patent Owner's argument, but find it unpersuasive of an unexpected result, on the current record. Patent Owner provides insufficient evidence, at this stage of the proceeding, of the existence of unexpected results that are attributable to the claimed particle size range. We do not give significant weight to Mr. Brown's testimony. Mr. Brown does not provide any evidentiary support for his assertions of an unexpected result. *See* Ex. 2001 ¶¶ 30–32 (providing testimony directed to unexpected results, including that "[i]t is [Mr. Brown's] belief that the use of . . . granular material has contributed to the unexpected performance success of the [claimed] composition," without providing any corroborating evidence).

i) Secondary considerations

We next turn to Patent Owner' evidence of secondary considerations. Patent Owner contends that the claimed composition has experienced commercial success. Prelim. Resp. 57–59. We must always consider, as part of an obviousness inquiry, this type of objective evidence, or secondary considerations evidence, when present. *Transocean Offshore Deepwater*

Drilling, Inc. v. Maersk Drilling USA, Inc., 699 F.3d 1340, 1349 (Fed. Cir. 2012).

(1) Nexus

As an initial matter, "[i]n order to accord substantial weight to secondary considerations in an obviousness analysis, the evidence of secondary considerations must have a nexus to the claims, *i.e.*, there must be a legally and factually sufficient connection between the evidence and the patented invention." *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (internal quotations omitted). "[A] patentee is entitled to a rebuttable presumption of nexus between the asserted evidence of secondary considerations and a patent claim if the patentee shows that the asserted evidence is tied to a specific product and that the product '*is* the invention disclosed and claimed.'" *Id.* Applying *Fox Factory*, the Board uses a two-step analysis in evaluating nexus between the claimed invention and the evidence of secondary considerations. *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 33 at 33 (PTAB Jan. 24, 2020) (precedential). We first consider whether the patent owner has demonstrated "that its products are coextensive (or nearly coextensive) with the challenged claims," resulting in a rebuttable presumption of nexus. *Id.* at 33. If not, that "does not end the inquiry into secondary considerations"; "the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the 'direct result of the unique characteristics of the claimed invention.'" *Id.* (quoting *Fox Factory*, 944 F.3d at 1373–75).

Patent Owner argues that "[t]he formula [Patent Owner] ultimately implemented at [Petitioner] is covered by the '276 [p]atent," and that Petitioner "practices the inventions disclosed and claimed in the '276 [p]atent." Prelim. Resp. 56. On the current record, we determine that Patent

Owner has not established that it is entitled to a presumption of nexus. A commercial product that is "covered by" a patent is not necessarily co-extensive with the product. For example, a composition may still fall within the scope of a claim, yet have additional constituents that could contribute to any commercial success. Further, testimony that "[t]he formula . . . required the blending of" recited elements of the claim 1, does not exclude that any number of other constituents were also included. Ex. 2001 ¶ 39. For completeness at this stage of the proceeding, however, we discuss Patent Owner's evidence of commercial success, below.

(2) Alleged commercial success

Patent Owner contends that the commercial product practicing the invention has reduced the sheeting cost of the material by thirty cents per pound. Prelim. Resp. 57; *see* Ex. 2001 ¶¶ 51–52 (indicating that costs were reduced from 80–82 cents per pound to 50–52 cents per pound). Patent Owner adds that Petitioner "declared publicly and to all of Petitioner's employees" that Patent Owner's "influence and the beneficial impact of his patented composition and process on Trienda's business has been 'immeasurable.'" *Id.* at 58. Patent Owner argues that Petitioner represents that "it is the largest heavy gauge thermoformer in North America and the leader in single sheet and twin sheet plastic thermoformed products," which "is done by use of [Patent Owner's] patented technology . . . claimed in the '276 [p]atent." *Id.* at 59.

On the current record, we do not afford Patent Owner's evidence of secondary considerations significant weight, even if we assume a nexus, as the evidence insufficient to demonstrate commercial success. First, Patent Owner does not sufficiently tie the reduction in material costs to composition of the product.

Second, Patent Owner relies on a marketing video by Petitioner, which is not part of the record. Also, although the marketing video indicates that Petitioner is "The Largest Heavy Gauge Thermoformer in North America," the boast seems limited to sheet plastic manufacturing. *See* Prelim. Resp. 58. Also, the evidence is unclear as to what the relevant market is. *Id.*; Ex. 2001 ¶ 55. Nor does Patent Owner offer any other evidence of market size and market share. Additionally, Petitioner has not had an opportunity to present evidence in rebuttal to Patent Owner's contentions with respect to the alleged secondary considerations. As such, we do not have the benefit of a complete record to make a determination as to whether any secondary considerations of nonobviousness outweigh Petitioner's evidence in support of this obviousness ground at this stage of the proceeding.

j) Conclusion

For the reasons discussed above, we determine, on the current record, that the information presented in the Petition shows a reasonable likelihood that claim 1 is unpatentable under 35 U.S.C. § 103 over Harris and Nakayama.

2. Independent claims 13 and 15

Patent Owner does not provide additional arguments directed to independent claims 13 and 15, which are directed to a product comprising the composition of claim 1, and a method of preparing a product with the composition of claim 1, respectively. *See* Ex. 1001, 8:21–39, 8:42–64; *see also* Pet. 47–52 (providing additional contentions with respect to independent claims 13 and 15). For the reasons discussed above in connection with our analysis of claim 1 (and our review of Petitioner's additional contentions directed at claims 13 and 15), we determine, on the

current record, that the information presented in the Petition shows a reasonable likelihood that claims 13 and 15 are unpatentable under 35 U.S.C. § 103 over Harris and Nakayama.

3. Dependent claims 2–12 and 14

Petitioner contends that dependent claims 2–12 and 14 are unpatentable as obvious over Harris and Nakayama. Petitioner has demonstrated a reasonable likelihood of success in proving that at least one claim of the '276 patent is unpatentable, and we institute on all challenges raised in the Petition. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1354, 1359–60 (2018); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require "a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition"); Patent Trial and Appeal Board Consolidated Trial Practice Guide 64 (Nov. 2019) ("The Board will not institute on fewer than all claims or all challenges in a petition."), *available at* https://www.uspto.gov/TrialPracticeGuideConsolidated ("CTPG").

Still, we have reviewed Petitioner's contentions and citations to the evidence and determine that Petitioner has made a sufficient showing, on the current record, of a reasonable likelihood that dependent claims 2–12 and 14 are unpatentable under 35 U.S.C. § 103 over Harris and Nakayama. Patent Owner does not separately argue any of the dependent claims at this stage of the proceeding.

E. Ground 2: Claims 1–5 as unpatentable over Thomas, Starita, and Nakayama

As we discussed above, because we institute trial in this proceeding, we institute on all challenges, including Ground 2. We do, however, address

Patent Owner's arguments directed to Ground 2 to allow the parties to better direct their briefing during trial.

1. Thomas as disclosing a lead compound or teaching away from Sample B3

Patent Owner directs us to the Manual of Patent Examining Procedure as it relates to modifying lead compounds. Specifically, Patent Owner quotes:

> "Obviousness based on structural similarity . . . can be proved by identification of some motivation that would have led one of ordinary skill in the art to select and then modify a known compound (i.e. a lead compound) in a particular way to achieve the claimed compound. . . . However, there must be some reason for starting with that particular lead compound other than the mere fact that the lead compound exists."

Prelim. Resp. 50 (quoting MPEP § 2143.I.B (Example 9))[12].

Patent Owner argues that there is no structural similarity between Sample B3—the sample disclosed in Thomas upon with Petitioner relies—and the composition claimed in claim 1. Prelim. Resp. 50–51. As to its teaching away argument, Patent Owner argues that "there is no motivation to use Sample B3 as a lead compound." *Id.* at 51. Patent Owner adds that Sample B3 has a poorer performance in certain tests as compared to other compositions. *Id.* at 51–53.

We have considered Patent Owner's arguments, but find that Petitioner's argument and evidence is sufficient, at this stage of the proceeding, with respect to what Thomas teaches, and that there would have been reasons to modify Sample B3. First, Patent Owner's reliance on

[12] The Preliminary Response cites to "§ 2143.I.A." This citation is an apparent typographical error, as Example 9 of subsection B is directed to lead compounds.

examining procedures directed to "lead compounds" is misplaced. As the section of the MPEP upon which Patent Owner relies expressly states:

> the term "lead compound" has been defined variously as "a chemical compound that has pharmacological or biological activity and whose chemical structure is used as a starting point for chemical modifications in order to improve potency, selectivity, or pharmacokinetic parameters;" "[a] compound that exhibits pharmacological properties which suggest its development;" and "a potential drug being tested for safety and efficacy."

MPEP § 2143.I.B (Example 9) (Rev. 10.2019, June 2020). As these definitions demonstrate, a "lead compound" has a specific use in the pharmaceutical arts, and Patent Owner provides no basis for how it extends to the compositions in this case.

Even if this consideration applied to the composition of claim 1, the record evidence points to express teachings in Thomas as to why a person having ordinary skill in the art would have looked to Thomas's Sample B3, including its recycled material content. *See* Ex. 1002 ¶ 193 (including citations to Thomas).

As to Patent Owner's arguments that Sample B3 did not perform as well as other sample on certain tests, and, thus, teaches away from the combination, we determine that Patent Owner does not sufficiently explain how Sample 3's performance would discourage its use. Indeed, Petitioner proposes to *modify* Sample B3 with Starita's teachings, which are directed, like Thomas, to corrugated pipe that will meet AASHTO standards. *See e.g.*, Pet. 54–55 (providing reasons to modify Thomas with Starita); Ex. 1006 ¶ 2 (discussing the field of Starita's invention).

Also, Patent Owner does not address why Thomas's disclosure of sample compositions, such as Sample B3, does not provide "the general

conditions of" claim 1 such that "discover[ing] the optimum or workable ranges by routine experimentation" would not have been obvious. *See In re Applied Materials*, 692 F.3d at 1295.

2. Modification rendering Thomas unsatisfactory for its intended purpose

Patent Owner argues that Petitioner's proposed modification of Thomas's Sample B3 would likely change the properties of the sample, rendering it inoperable for its intended purpose. Prelim. Resp. 53. Patent Owner argues that Petitioner did not provide any analysis of the properties of the modified composition, including a prediction of stress crack resistance. *Id.* at 54.

We have considered Patent Owner's argument, but find it insufficient, at this stage of the proceeding, to demonstrate that the proposed modification would render Thomas's Sample B3 unsatisfactory for its intended purpose. First, the intended purpose of Sample B3, even in its narrowest sense, is to be a test sample comprising a blend of virgin and recycled polyethylene resins upon which tests may be conducted. Petitioner's proposed modification of Thomas's Sample B3 would still result in a blend of virgin and recycled polyethylene resins upon which tests may be conducted. Second, Petitioner proposes modifying Thomas's teachings with the teachings of Starita, and both references are directed at compositions used for corrugated piping.

IV. CONCLUSION

Based on the information presented, we determine Petitioner has established a reasonable likelihood that it would prevail with respect to at

least one of the Challenged Claims. Accordingly, we institute an *inter partes* review on all challenges.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is instituted as to claims 1–15 of U.S. Patent No. 10,570,276 B2;

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

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