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PUBLIC VERSION WITH REDACTIONS

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BAKER HUGHES, a GE COMPANY, LLC
(f/k/a BAKER HUGHES INCORPORATED),[1]
Petitioner,

v.

LIQUIDPOWER SPECIALTY PRODUCTS INC.
(f/k/a LUBRIZOL SPECIALTY PRODUCTS, INC.),
Patent Owner.

Case IPR2016-00734
Patent 8,022,118 B2

Before KRISTINA M. KALAN, CHRISTOPHER M. KAISER, and MICHELLE N. ANKENBRAND, *Administrative Patent Judges.*

ANKENBRAND, *Administrative Patent Judge.*

FINAL WRITTEN DECISION

Finding Claims 1–11 Unpatentable
35 U.S.C. § 318(a); 37 C.F.R. § 42.73

Dismissing Patent Owner's Motion to Exclude
37 C.F.R. § 42.64(c)

Denying Without Prejudice Petitioner's and Patent Owner's Motions to Seal
37 C.F.R. § 42.54

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[1] Petitioner represents that its name has changed from Baker Hughes Incorporated to Baker Hughes, a GE Company, LLC. Paper 78, 2. Accordingly, we modify the case caption to reflect that change.

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review challenging the patentability of claims 1–11 (collectively, "the challenged claims") of U.S. Patent No. 8,022,118 B2 (Ex. 1001, "the '118 patent"). We have jurisdiction under 35 U.S.C. § 6. For the reasons that follow, we determine that Petitioner demonstrates, by a preponderance of the evidence that claims 1–11 are unpatentable.

A. Procedural History

Baker Hughes, a GE Company, LLC ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting an *inter partes* review pursuant to 35 U.S.C. § 311.[2] On October 4, 2016, we instituted trial to determine:

(1) Whether claims 1, 3, 4, 6, 7, and 11 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Eaton;[3]

(2) Whether claims 1–7 and 11 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Eaton and Strausz;[4] and

(3) Whether claims 8–10 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Eaton, Strausz, and Naiman.[5]

Paper 9 ("Institution Decision" or "Inst. Dec.").

During trial, Liquid Power Specialty Products Inc. ("Patent Owner") filed a Response (Paper 48, "Resp." (public version)), and Petitioner filed a

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[2] In support of the Petition, Petitioner filed a declaration of Thomas H. Epps, III, Ph.D. (Ex. 1005).
[3] U.S. Patent No. 6,015,779, issued January 18, 2000 ("Eaton") (Ex. 1002).
[4] OTTO P. STRAUSZ & ELIZABETH M. LOWN, THE CHEMISTRY OF ALBERTA OIL SANDS, BITUMENS AND HEAVY OILS 464–480 (2003) ("Strausz") (Ex. 1003).
[5] U.S. Patent No. 4,983,186, issued January 8, 1991 ("Naiman") (Ex. 1004).

Reply (Paper 59, "Reply" (public version)).[6] During an interlocutory teleconference on May 24, 2017, we authorized Patent Owner to file a Sur-Reply limited to responding to arguments and evidence presented in Petitioner's Reply regarding claim construction of the phrase "about 26 degrees" and objective indicia of nonobviousness. Paper 71, "Sur-Reply" (public version)[7]; *see* Ex. 2310, 23–25 (transcript of teleconference) (authorizing Patent Owner's Sur-Reply). Patent Owner and Petitioner filed motions to seal their respective briefs and certain exhibits that contain information the parties assert is confidential information of Petitioner, Patent Owner, or non-party Flowchem LLC ("Flowchem"). Paper 46 (Patent Owner's first Motion to Seal); Paper 58 (Petitioner's Motion to Seal); Paper 69 (Patent Owner's second Motion to Seal).

Further, Patent Owner filed, and Petitioner responded to, observations on the cross-examination testimony of Dr. Epps. Paper 66 (Observations); Paper 73 (Petitioner's Response). Patent Owner also filed a Motion to Exclude, which is fully briefed. Paper 65 (Motion); Paper 72 (Petitioner's Opposition); Paper 37 (Patent Owner's Reply). The record further includes a transcript of the final oral hearing conducted on June 19, 2017. Paper 76 ("Tr.") (public portion of the hearing); Paper 77 (confidential portion of the hearing).

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[6] With the Response, Patent Owner filed a declaration of Brian Dunn, Ph.D. (Ex. 2021 (public version)). With the Reply, Petitioner filed a reply declaration of Dr. Epps (Ex. 1056 (public version)). All citations to the Response, Reply, Dr. Dunn's declaration, and Dr. Epps's reply declaration are to the public versions of those Papers and Exhibits, unless otherwise noted.

[7] All citations to Patent Owner's Sur-Reply are to the public version of the document unless otherwise noted.

B. Related Proceedings

The parties identify the following litigation involving the '118 patent, and patents related to the '118 patent: *Lubrizol Specialty Products, Inc. v. Baker Hughes Inc.*, No. 4:15-cv-02915 (S.D. Tex.) and *Lubrizol Specialty Products, Inc. v. FLOWCHEM LLC*, No. 4:15-cv-02917 (S.D. Tex.). Pet. 2–3; Paper 6, 2.

Petitioner identifies three additional instituted *inter partes* review proceedings involving Petitioner's challenges to patents related to the '118 patent: IPR2016-01901 (challenging U.S. Patent No. 8,450,249), IPR2016-01903 (challenging U.S. Patent No. 8,426,498), and IPR2016-01905 (challenging U.S. Patent No. 8,450,250). Paper 78, 3. According to Patent Owner, the patents challenged in those *inter partes* review proceedings also are asserted in the litigation between the parties. Paper 6, 2.

The parties also identify patents and pending patent applications that are related to the '118 patent. Patent Owner identifies U.S. Patent Nos. 8,450,251; 8,616,236; and 8,656,950 as related. Paper 6, 2. The parties identify U.S. Patent Application No. 13/209,119, filed on August 12, 2011, and U.S. Patent Application No. 15/148,332, filed on May 6, 2016, and represent that those applications claim benefit to, and are continuations in part of, the application that matured into the '118 patent. Pet. 3; Paper 6, 3; Paper 78, 4.

C. The '118 Patent

The '118 patent, titled "Drag Reduction of Asphaltenic Crude Oils," issued on September 20, 2011. The '118 patent relates to "reducing pressure drop associated with the turbulent flow of asphaltenic crude oil through a conduit" by "treating the asphaltenic crude oil [i.e., crude oil having an

asphaltene content of at least 3 weight percent and/or an API gravity of less than about 26°] with a high molecular weight drag reducing polymer that can have a solubility parameter within about 20 percent of the solubility parameter of the heavy crude oil." Ex. 1001, Abstract.

According to the specification, "[w]hen fluids are transported by a pipeline, there is typically a drop in fluid pressure due to the friction between the wall of the pipeline and the fluid." *Id.* at 1:14–16. The pressure drop increases with increasing flow rate, resulting in energy losses and inefficiencies that increase equipment and operation costs. *Id.* at 1:16–26. The problems associated with pressure drop are most acute when fluids are transported over long distances. *Id.* at 1:24–25.

Before the '118 patent, it was known to use drag reducing polymers in the fluid flowing through a pipeline to alleviate the problems resulting from pressure drop. *Id.* at 1:28–30. A drag reducing polymer "is a composition capable of substantially reducing friction loss associated with the turbulent flow of a fluid through a pipeline," and such a composition works by "suppress[ing] the growth of turbulent eddies, which results in higher flow rate at a constant pumping pressure." *Id.* at 1:32–37. Drag reduction generally "depends in part upon the molecular weight of the polymer additive and its ability to dissolve in the hydrocarbon under turbulent flow." *Id.* at 1:39–41.

According to the specification, because conventional drag reducing polymers do not perform well in crude oils having a low API gravity[8] and/or

[8] The specification defines API gravity as "the specific gravity scale developed by the American Petroleum Institute for measuring the relative density of various petroleum liquids." *Id.* at 3:61–64.

a high asphaltene content (i.e., heavy crude oils), there exists a need for improved drag reducing polymers capable of reducing the pressure drop associated with the turbulent flow of heavy crude oils through pipelines. *Id.* at 1:46–49. The subject matter of the disclosed invention, therefore, "relates generally to high molecular weight drag reducers for use in crude oils." *Id.* at 1:7–8. More specifically, the '118 patent discloses a method for reducing the pressure drop associated with flowing a liquid hydrocarbon through a conduit, such as a pipeline. *Id.* at 2:58–60. The method comprises introducing a drag reducing polymer into a liquid hydrocarbon having an asphaltene content of at least about 3 weight percent and an API gravity of less than about 26° (i.e., heavy crude oil) to produce a treated liquid hydrocarbon having a viscosity that is not less than the viscosity of the liquid hydrocarbon prior to treatment with the drag reducing polymer. *Id.* at 19:32–42. The '118 patent provides several examples of suitable heavy crude oils, including Bow River crude oil. *Id.* at 4:37–42, Table 1.

The specification further explains that, "[i]n order for the drag reducing polymer to function as a drag reducer, the polymer should dissolve or be substantially solvated in the liquid hydrocarbon." *Id.* at 11:38–40. The liquid hydrocarbon and the drag reducing polymer, therefore, have solubility parameters that can be determined according to known methods, and the claims set forth certain solubility parameters and ranges of solubility parameters. *Id.* at 4:19–32 (setting forth known methods for determining the solubility parameter of the liquid hydrocarbon), 11:46–12:23 (setting forth known methods for determining the solubility parameter of the drag reducing polymer); *see, e.g.*, *id.* at 19:43–45 ("the drag reducing polymer

has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of the liquid hydrocarbon").

D. Illustrative Claim

Of the challenged claims, claims 1, 10, and 11 are independent claims. Claim 1 is illustrative of the claimed subject matter and recites:

> 1. A method comprising:
>
> introducing a drag reducing polymer, into a pipeline, such that [sic] such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies, into a liquid hydrocarbon having an asphaltene content of at least 3 weight percent and an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon wherein the viscosity of the treated liquid hydrocarbon is not less than the viscosity of the liquid hydrocarbon prior to treatment with the drag reducing polymer;
>
> wherein the drag reducing polymer has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of the liquid hydrocarbon and
>
> the drag reducing polymer is added to the liquid hydrocarbon in the range from about 0.1 to about 500 ppmw.

Ex. 1001, 19:32–47.

Claims 2–9 depend ultimately from claim 1 and, therefore, inherit the limitations of claim 1. Claims 2–4 further require a drag reducing polymer (1) having a solubility parameter of "at least about 17 $MPa^{1/2}$" (claim 2), (2) comprising "at least about 25,000 repeating units" (claim 3) and (3) having a weight average molecular weight of "at least $1x10^6$ g/mol" (claim 4). *Id.* at 19:48–54. Claim 5 narrows the solubility parameter of the drag reducing polymer to one that is "within 2.5 $MPa^{1/2}$ of the liquid hydrocarbon." *Id.* at 19:55–57. Claims 6 and 7 set forth equations for determining the solubility parameters of the liquid hydrocarbon and drag

reducing polymer, respectively. *Id.* at 19:58–20:7. Claim 8 narrows the method of claim 1 to one in which a plurality of the drag reducing polymer's repeat units comprise a heteroatom, and claim 9 further limits the heteroatom to one "selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom and/or a phosphorus atom." *Id.* at 20:8–12. Independent claims 10 and 11 recite methods similar to claim 1, and incorporate some of the additional limitations recited in the dependent claims. Claim 10 incorporates the limitations for the drag reducing polymer solubility parameter, repeat units, and molecular weight set forth in claims 2–4, as well as the heteroatom limitations of claims 8 and 9. *Id.* at 20:13–36. Claim 11 incorporates the limitations of claims 6 and 7. *Id.* at 20:37–64.

II. DISCUSSION

Petitioner bears the burden of proving unpatentability of the challenged claims, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must establish the facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). Below, we explain why Petitioner has met its burden with respect to the challenged claims.

A. Level of Ordinary Skill in the Art

We begin our analysis by addressing the level of ordinary skill in the art. Dr. Epps testifies a person of ordinary skill in the art would have had familiarity with basic principles related to polymers and polymer synthesis, including chemical composition of monomers and polymers, common types of polymerization processes, types of polymerization catalysts, and solubility properties of polymers. Ex. 1005 ¶ 14 (citing Ex. 1007). The

ordinarily skilled artisan, according to Dr. Epps, also would have been aware of and consulted technical publications directed to the physical and chemical properties of drag reducing polymers and the study of polymer flow properties in solution, and utilized the techniques in those publications to determine properties such as the solubility parameters of polymers. *Id.* ¶¶ 15–16 (citing Ex. 1003; Ex. 1008; Ex. 1009). Moreover, Dr. Epps testifies that such a person typically would have had a Bachelor of Science degree in chemical engineering, polymer science and engineering, or a closely related field, and at least two years of work experience or further academic experience with drag reducing polymers or polymer flow properties in solution for any fluid. *Id.* ¶ 18.

Dr. Dunn defines the ordinarily skilled artisan in a similar manner with respect to education and experience, i.e., "an undergraduate degree in chemical engineering, or an equivalent science or engineering degree," with 1–2 years of work experience in petroleum engineering or pipeline operations, or the "equivalent graduate-level education or field experience." Ex. 2021 ¶ 19; *see* Resp. 57.

The parties' experts' testimony regarding the education level and experience of the person of ordinary skill in the art have slight distinctions, which we find to be of little consequence in this case. We adopt the following as the level of ordinary skill in the art: an undergraduate degree in chemical engineering, polymer science and engineering, or a closely-related field, and at least two years of work experience in pipeline operations or petroleum engineering, including synthesis and properties of drag reducing polymers for use in pipeline operations. In the absence of such work

experience, the person of ordinary skill in the art would have the equivalent graduate-level education.

Although the parties largely agree as to the level of skill in the art, Dr. Dunn disagrees with Dr. Epps that a skilled artisan would have had a reason to consult "references like Strausz, to solve problems of drag reduction in pipelines prior to the invention of the '118 patent." Ex. 2021 ¶ 22. Dr. Dunn testifies that "Strausz concerns the chemistry of bitumen," not drag reduction, and that "the usefulness of Strausz . . . was an inventive aspect of the 118 patent." *Id.* ¶ 24. Nevertheless, Dr. Dunn states that his opinions "would remain the same even if Dr. Epps's opinion concerning the level of ordinary skill in the art were applied." *Id.* ¶ 26.

According to the background section of the '118 patent, it was known that conventional drag reducers do not perform well in crude oils having a low API gravity and/or a high asphaltene content, and a need existed for drag reducing polymers that would perform in such crude oils. Ex. 1001, 1:44–49. As explained in further detail below, Strausz is directed to the chemistry of crude oils, including the properties of asphaltene. *See generally* Ex. 1003. Strausz states that properties of asphaltene in crude oil "are of considerable interest to all phases of the petroleum industry—recovery, transportation, storage, refining, [and] upgrading. . . ." *Id.* at 464. In other words, Strausz indicates that its teachings are important to a person with work experience in petroleum engineering or pipeline operations—the types of persons possessing ordinary skill in the art. Thus, we find that a person of ordinary skill in the art (e.g., a person with work experience in petroleum engineering or pipeline operations or the equivalent graduate-level education) seeking to improve upon conventional drag reducing

polymers in order to reduce drag in heavy crude oils would have consulted references related to the chemistry and flow properties of heavy crude oils, such as Strausz.

Based on their stated qualifications, we consider both Dr. Epps and Dr. Dunn qualified to opine from the viewpoint of a person of ordinary skill in the art regarding the subject matter of the '118 patent. Ex. 1006 (Dr. Epps's curriculum vitae); Ex. 2021, Attachment A (Dr. Dunn's curriculum vitae).

B. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

We determined in the Institution Decision that no claim term required express construction based on the record developed at that stage of the proceeding. Inst. Dec. 8–9. We found, however, that Patent Owner's arguments in its Preliminary Response "implicate[d] claim construction of the phrase [API gravity of] 'less than about 26°,'" which neither party addressed at that stage of the proceeding. *Id.* at 18. Accordingly, we invited the parties to present arguments during the course of trial regarding the broadest reasonable construction of that phrase. Additionally, Patent Owner

proposes that we construe the term "pipeline" that is part of the limitation "introducing a drag reducing polymer[] into a pipeline." Resp. 7–8.

Claim terms only need to be construed to the extent necessary to resolve a controversy between the parties. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). Here, although Patent Owner proposes a construction for the term "pipeline," we find that no genuine dispute exists among the parties as to the proper construction of that term. Rather, the parties' dispute centers on whether the prior art discloses "introducing a drag reducing polymer[] into a pipeline," as required by the challenged claims. *See, e.g.*, Pet. 23–24; Resp. 15–18; Reply 4. Thus, because the dispute primarily involves "introducing a drag reducing polymer" rather than the meaning of the term "pipeline" itself, we need not construe the term "pipeline."

After reviewing the entire record developed during trial, we determine that only the phrase "less than about 26°" requires construction.

"less than about 26°"

Petitioner asserts that the broadest reasonable interpretation of the phrase "less than about 26°" means "less than approximately 26°." Reply 1. Petitioner frames the disputed issue as centering around the meaning of "about." *Id.* at 2. Petitioner asserts, and Dr. Epps testifies, that a person of ordinary skill in the art would understand the term "about" to "include a variance of, at a minimum, ± 1 of the least significant figure in the value expressed," as a convention often used in scientific work. In the case of 26°, this is the 6. Reply 2; Ex. 1056 ¶¶ 2–6. If the expressed value required more precision, Dr. Epps explains, a person of ordinary skill in the art would expect that the number would be expressed with at least one additional

significant figure or some other indication of greater precision. Ex. 1056 ¶ 2. Thus, under Petitioner's proffered construction, an API gravity of "less than about 26°" would encompass any API gravity value less than exactly 27°.

Patent Owner contends that a person of ordinary skill in the art would have understood that the term "about" "refers to the experimental uncertainty (± 0.5°)" in the API gravity test method disclosed in the '118 patent. Sur-Reply 1 (citing Ex. 2021 ¶¶ 29–32). Thus, according to Patent Owner, the broadest reasonable interpretation of the phrase "less than about 26°" "requires that the liquid hydrocarbon have 'an API gravity of less than 26.5°.'" Resp. 4–6.

The use of the word "about" "avoids a strict numerical boundary to the specified parameter." *Ortho-McNeill Pharm., Inc. v. Caraco Pharm. Labs., Ltd.*, 476 F.3d 1321, 1327 (Fed. Cir. 2007). The word "about," however, "does not have a universal meaning in patent claims, and [its] meaning depends on the technological facts of the particular case." *Pall Corp. v. Micron Separations, Inc.*, 66 F.3d 1211, 1217 (Fed. Cir. 1995). In evaluating the scope of the word "about," it is appropriate to look to how the specification and other claims use the term, as well as considering the effects of varying the parameter described by the term. *Id.*

Here, although several additional claims use the word "about," none of the claims provide guidance regarding the upper limit of "about 26°." The specification of the '118 patent, however, supports a broader variance in the term "about" than the construction that Patent Owner proffers. For example, the specification describes pipeline testing of the different drag reducing polymers in several crude oils ranging from light to heavy and sets

forth some of the properties of those crude oils. Ex. 1001, 17:10–23. With respect to Test 1, conducted in West Texas Intermediate crude oil, the specification states that West Texas Intermediate crude oil "generally ha[s] an API gravity of *about* 40°." *Id.* at 17:12–14 (emphasis added). Table 1 of the specification, however, reports an API gravity of 41.6° for West Texas Intermediate crude oil, which is 1.6° higher than the 40° value. Thus, the specification contemplates a variation of at least 1.6° in the upper limit of the term "about."

The specification also explains that although it sets forth "specific numerical values to quantify certain parameters relating to the invention," "[i]t should be understood that each specific numerical value provided herein is to be construed as providing literal support for a broad, intermediate, and narrow range." Ex. 1001, 18:35–41. During oral argument, counsel for Patent Owner stated that such language was a disclosure of "alternative embodiments." Tr. 31:24–32:25. Thus, Patent Owner acknowledges that when the '118 patent describes an API gravity of "less than about 26°," such description is actually a disclosure of a number of alternative embodiments that can be somewhat greater than 26°.

We also reject Patent Owner's argument that "about 26°" should be limited to the experimental uncertainty associated with the API gravity calculation set forth in the '118 patent. As counsel for Patent Owner admitted at the oral hearing, the reproducibility associated with the API gravity calculation set forth in the '118 patent reflects the uncertainty that a reported value of exactly 26° would encompass. Tr. 36:20–37:3. In other words, Patent Owner's construction of the phrase "less than about 26°" reads the word "about" out of the claim phrase. We, however, interpret claims

"with an eye toward giving effect to all terms in the claim." *Bicon Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006).

In light of the foregoing, we find that the broadest reasonable interpretation of the phrase "less than about 26°" encompasses API gravity values up to at least 27.6°.

C. Overview of Asserted References

Before turning to the instituted grounds, we begin with a brief summary of the asserted references.

1. Eaton

Eaton discloses "methods for improving the flow of hydrocarbons through conduits, particularly viscous crude oil flowing through pipelines," including methods for making improved drag reducing agents having ultra-high molecular weight. Ex. 1002, 1:11–18, 1:66–2:9. The drag reducing agent, which is added to the hydrocarbon at a concentration from 1–250 parts per million by weight (ppmw), improves flow by "reducing frictional pressure losses, or frictionally generated energy bursts, associated with movement of fluid within the conduit." *Id.* at 2:32–39, 5:13–17. In other words, the drag reducing agent "tend[s] to reduce the impact of turbulence through direct interaction and absorption of some or most of the[] energy bursts thus improving flow characteristics in the conduit." *Id.* at 5:20–24.

Eaton discloses that the drag reducing agent should have the right combination of properties to provide drag reduction and flow improvement. *Id.* at 5:24–26. For instance, the drag reducing agent should be non-crystalline and amorphous, have an ultra-high molecular weight (at least 10 or 15 million g/mol), and provide superior flow improvement. *Id.* at 5:26–30, 6:15–32. Eaton further discloses methods of making the drag reducing

agents, which Eaton describes as compositions that include at least a polyalphaolefin polymer. *Id.* at 4:56–59. The methods employ a catalyst system that includes a transition metal catalyst and a co-catalyst mixture, preferably containing an alkylaluminoxane co-catalyst. *Id.* at 6:57–60.

In Example 1, Eaton compares four different drag reducing agents (compositions A, B, C, and D) for their ability to increase flow of various hydrocarbons, including Bow River crude oil, which Eaton describes as "a highly viscous crude oil from the IPL pipeline in Canada." *Id.* at 13:57–58, 14:33–38. Compositions A and B are polyalphaolefins made using the described methods with alkylaluminoxane as a co-catalyst, and compositions C and D are commercially available drag reducing compositions made without an alkylaluminoxane. *Id.* at 13:63–14:5. Each of the drag reducing agents was measured for percent flow increase in a one-inch or quarter-inch hydraulic flow loop. *Id.* at 14:33–39. The one-inch loop was used to test the Bow River crude oil because it is too viscous to generate turbulent flow in a quarter-inch loop. *Id.* at 14:40–42. Eaton states that the results obtained with Compositions A and B are "indicative of the superior drag reducing capabilities of the present invention in an actual commercial setting," because both compositions "increased the flow rate of BOW RIVER crude oil, while neither compositions 'C' nor 'D' were able to increase the flow of the BOW RIVER crude oil." *Id.* at 14:62–67. Table 1 is reproduced below.

TABLE I

	PERCENT FLOW INCREASE		
DRA	ANS @3 ppm	BOW RIVER @4.6 ppm	HEXANE @1 ppm
A	15.0	3.0	40.1
B	12.0	5.5	37.5
C[1]	10.8	–0.5	31.1
D[2]	—	0.0	27.1

[1]LIQUID POWER ™ commercial DRA from Conoco Inc.
[2]FLO-1005 ™ commercial DRA from Baker-Hughes, Inc.

Table 1 indicates that compositions A and B increased the flow rate of Bow River crude oil by 3.0% and 5.5%, respectively, when added at a concentration of 4.6 ppmw. *Id.* at 15:1–12 (Table 1).

2. Strausz

Strausz is a book containing relationships and parameters concerning solubilization of materials, such as polymers, in crude oil. Strausz discloses that "[t]he ability of a solvent to solubilize asphaltene or, in general, to dissolve a solid or to form a homogeneous solution with another liquid, may be expressed in terms of solubility parameters." Ex. 1003, 465. Strausz provides several equations for determining solubility parameters, including the equation provided in the specification of the '118 patent for determining the solubility parameter of a liquid hydrocarbon. *Id.* at 465–66 (cited in Ex. 1001, 4:20–32). Strausz explains that, although the solubility parameter theory, which can estimate solubility of one material in another by comparing calculated parameter values for both materials, "would not be expected to be applicable for colloidal aggregate solutions of polar, random, polydispersed macromolecules like asphaltene . . . the correlation between

the solubility of asphaltene and solvent solubility parameter is quite good for nonpolar and low-polarity solvents." *Id.* at 466.

In that regard, Strausz describes a study of the correlation between asphaltene solubility and solubility parameters. *Id.* at 467. The study determined that "asphaltene becomes completely soluble in hydrocarbons with [a solubility parameter] $\geq$ 17.1 $MPa^{1/2}$" and that the solvation energy of hydrocarbon solvents with a solubility parameter "in the 17.1–22.1 $MPa^{1/2}$ range is sufficiently large to overcome the cohesion energy of asphaltene and cause solubilization." *Id.* The study also established the solubility parameter of asphaltene "as not less than 19.6 $MPa^{1/2}$." *Id.*

3. Naiman

Naiman describes the problems associated with frictional pressure drop during the long distance transport of crude oil through pipelines, and also describes the use of drag reducing agents to produce a less turbulent flow, thereby reducing the pressure loss due to friction. Ex. 1004, 1:14–27. Naiman explains that conventional drag reducing agents suffer drawbacks. For example, although effectiveness of the agents increases with increasing molecular weight, solubility in the hydrocarbon fluid decreases with increasing molecular weight. *Id.* at 1:39–47. To that end, Naiman discloses new additives for reducing "friction encountered in the flow of hydrocarbon fuels through conduits." *Id.* at 1:7–12. In particular, Naiman discloses adding to the hydrocarbon fluid "an effective amount of an oil-soluble polyamine and a terpolymer of styrene, alkyl acrylate and a carboxylic acid." *Id.* at Abstract. The styrene component increases the molecular weight of the polymer and the alkyl acrylate provides the polymer with improved oil solubility. *Id.* at 2:56–62. Naiman explains that the drag reducing polymer

"has sufficient molecular weight to be effective, yet is soluble in hydrocarbons." *Id.* at 2:6–10.

According to Naiman, preferred polymers are oil-soluble, even at concentrations that are significantly higher than those encountered in drag reducing applications. *Id.* at 3:58–62. The polymers have a molecular weight of about 3,000,000 to about 5,000,000. *Id.* at 3:46–48. The polymer is added, at a concentration from about 3 ppmw to about 35 ppmw, to a hydrocarbon fluid (e.g., crude oil) flowing through a conduit. *Id.* at 4:1–4, 12–21.

Naiman also teaches that a carboxylic acid can be introduced into the polymer and a basic polyamine can be reacted with the polymer to form an oil-soluble salt of higher effective molecular weight than the original polymer. *Id.* at 4:26–34. According to Naiman, the salt is "an especially effective high molecular weight, oil-soluble drag reducing agent." *Id.* at 4:34–37.

In Example 2, Naiman reports the results of an experiment in which 100 ppmw of (a) various polymers and (b) combinations of polymer and polyamine were introduced into kerosene, and the percentage of drag reduction over the untreated fluid was measured. *Id.* at 5:20–25. Tables I and II show that polymer consisting of about 62–63 wt. percent 2-ethyl-hexyl acrylate and about 37–38 wt. percent styrene achieved a drag reduction of about 21–26%. *Id.* at 5:9–17 (Table I), 5:43–52 (Table II, polymers 1 and 5). Similar polymers that were made acidic and reacted with polyamine achieved a drag reduction of about 19–39%. *Id.* at 5:43–52 (Table II, polymers 2–4 and 6). Drag reduction was determined by measuring the pressure drop over a length of pipe for untreated kerosene and

the pressure drop over a length of pipe for treated kerosene, and comparing the difference. *Id.* at 5:35–41.

D. Ground 1: Anticipation of Claims 1, 3, 4, 6, 7, and 11 by Eaton

Petitioner argues that Eaton discloses every limitation of claims 1, 3, 4, 6, 7, and 11. Pet. 23–40. Petitioner supports its argument with citations to Eaton that correspond to each limitation of the claims, and with Dr. Epps's Declaration. *Id.* (citing Ex. 1002, 1:30–33, 1:66–2:9, 2:35–40, 5:8–23, 6:15–36, 11:43–67, 14:13–19, 14:33–38, 14:55–59, 15:1–12; Ex. 1005 ¶¶ 32, 45, 48, 50–56, 58, 62, 63, 66–75). Patent Owner disagrees, arguing that Petitioner fails to meet its burden with respect to three limitations recited in claim 1, and required by all of the challenged claims: (1) a liquid hydrocarbon having "an API gravity of less than about 26°" (the "API gravity limitation"); (2) "introducing a drag reducing polymer, into a pipeline, such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies"; and (3) "the drag reducing polymer has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of the liquid hydrocarbon" (the "solubility parameter limitation"). Resp. 8–27. Based on our review of the arguments and evidence of record, we determine that Petitioner demonstrates, by a preponderance of the evidence, that Eaton anticipates claims 1, 3, 4, 6, 7, and 11, as explained below.

1. Legal standards

To establish anticipation, each limitation in a claim must be found in a single prior art reference, arranged as recited in the claim. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). Although the elements must be arranged or combined in the same way as in the claim,

"the reference need not satisfy an *ipsissimis verbis* test." *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009). In particular,

> A single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation. Thus, a prior art reference without express reference to a claim limitation may nonetheless anticipate by inherency. "Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claims limitations, it anticipates."

Perricone v. Medicis Pharm. Corp., 432 F.3d 1368, 1375–76 (Fed. Cir. 2005) (citations omitted). A reference inherently discloses an element of a claim "if that missing characteristic is necessarily present" in the reference. *Sobering Corp. v. Geneva Pharms., Inc.*, 339 F.3d 1373, 1379 (Fed. Cir. 2003). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed. Cir. 2010) (citing *Cont'l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1269 (Fed. Cir. 1991)).

2. Analysis

We begin our analysis by addressing the parties' arguments as to the disputed limitations of claim 1, and then turn to the additional limitations of claim 1, as well as the limitations of claims 3, 4, 6, 7, and 11.

a. The API gravity limitation

Claim 1 recites that the drag reducing polymer is introduced "into a liquid hydrocarbon having . . . an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon," i.e., the API gravity

limitation.[9] Petitioner argues Eaton discloses that limitation of the claims. Pet. 27. Specifically, Petitioner points to Eaton's Example 1, which describes introducing four different drag reducing polymers into Bow River crude oil to compare their ability to increase the flow of Bow River crude oil in a flow loop. *Id.* at 25–26, 33–34; Ex. 1002, 13:57–15:12. Because Eaton does not expressly disclose the API gravity of Bow River crude oil, Petitioner relies on inherency. *Id.* at 26–27 (noting that Table 1 of '118 patent discloses an API gravity for Bow River crude oil of 21.8°), 35; Reply 5 (citing Ex. 1047; Ex. 1048, 8; Ex. 1049).

Patent Owner counters that Petitioner fails to meet its burden of showing that the Bow River crude oil used in Eaton's Example 1 necessarily has an API gravity of less than about 26°. Resp. 11–14. In particular, Patent Owner contends that the person of ordinary skill in the art "could not have" assumed that the Bow River crude oil disclosed in Eaton has the same API gravity as that provided in Table 1 of the '118 patent because: (1) the label "Bow River crude oil" can refer to at least two different fields that produce crude oils having different API gravities, *id.* at 11 (citing Ex. 2021 ¶ 47; Ex. 2030 ¶ 52); (2) it was known in the art that oil samples taken from the same

[9] The claims also require that the liquid hydrocarbon have an asphaltene content that is at least 3 weight percent. Ex. 1001, 19:32–37. In arguing that Eaton discloses that limitation, Petitioner points to the asphaltene content of Bow River crude oil that is reported in Table 1 of the '118 patent. Pet. 26–27. Patent Owner does not dispute Petitioner's showing in that regard. *See generally* Resp. We find that Petitioner establishes, by a preponderance of the evidence, that Bow River crude oil has an asphaltene content that falls within the recited "at least 3 weight percent." *See* Ex. 1001, 14:52–67 (Table 1, disclosing that Bow River crude oil is a heavy crude oil with an asphaltene content between 10.3 and 11.4).

geographic region can have different API gravity measurements, especially when the samples are taken years apart (i.e., Eaton's sample was taken around 1998 and the Table 1 sample was taken eight years later around 2006), *id.* (citing Ex. 2021 ¶¶ 45–46, Ex. 2028; Ex. 2029); Ex. 2021 ¶ 49; and (3) Eaton's Bow River sample was taken from the IPL Pipeline, which carries blended crude oil, and blended crude oil can have seasonal variations in the amounts of diluent and, therefore, API gravity, *id.* at 11–12 (citing Ex. 1002, 14:36–38; Ex. 2021 ¶¶ 48–49).

Patent Owner also points to Dr. Dunn's calculations, which Patent Owner contends indicate that the Bow River crude oil in Eaton's Example 1 "most likely was diluted further, which raised the API gravity further, in order to perform the laboratory test in the one-inch flow loop." *Id.* at 12 (citing Ex. 2021 ¶ 50). Finally, Patent Owner asserts that Eaton does not disclose the API gravity limitation under Patent Owner's construction of the phrase "less than about 26°." *Id.* at 14–15.

After having considered the parties' arguments and the evidence of record, we are persuaded that Petitioner shows, by a preponderance of the evidence, that Eaton inherently discloses the API gravity limitation.

As an initial matter, we note that, during prosecution, Patent Owner explained to the Office that the liquid hydrocarbon characteristics or properties recited in the challenged claims, i.e., "an asphaltene content of at least 3 weight percent and an API gravity of less than about 26°," merely specify that the liquid hydrocarbon is a heavy crude oil. Ex. 1023, 8 ("The specific characteristics of applicant's liquid hydrocarbon [i.e., an asphaltene content of at least 3 weight percent and an API gravity of less than about 26°] are defined by one skilled in the art as 'heavy crude oil' or 'heavy

crude.'"). Thus, Bow River crude oil would satisfy the API gravity limitation if the evidence establishes that Bow River crude oil is a heavy crude oil. Here, the record evidence indicates that Bow River crude oil is, indeed, a heavy crude oil. For example, Table 1 of the '118 patent specifies that Bow River crude oil is a heavy crude oil. Ex. 1001, Table 1. The '118 patent also explains that Bow River crude oil is a suitable example of a heavy crude oil liquid hydrocarbon that can be used in the disclosed methods. *Id.* at 4:37–42. Additional record evidence establishes that Bow River crude oil is a heavy crude oil. *See, e.g.*, Ex. 2005, 120 (providing characteristics and properties for "Bow River Heavy" crude oil); Ex. 2009, 106 (providing physical properties for "Bow River Heavy" crude oil); Ex. 2019, 103 (describing Bow River crude oil as a conventional heavy sour crude).

Nevertheless, we address Patent Owner's arguments to the contrary. We agree with Patent Owner that Eaton does not expressly disclose an API gravity of Bow River crude oil. When an anticipatory reference "is silent about an asserted inherent characteristic," however, "such [a] gap in the reference may be filled with recourse to extrinsic evidence," as long as that evidence "make[s] clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Cont'l Can*, 948 F.2d at 1268 (Fed. Cir. 1991).

Here, the evidence of record "make[s] clear" that Bow River crude oil necessarily has an API gravity of "less than about 26°," as we have construed that phrase. Patent Owner concedes that the highest reported API gravity for Bow River crude oil in the record is 26.7°. *See* Tr. 27:1–6, 28:2–

5 ("I will concede that the highest number that we supplied in the evidence for Bow River crude was 26.7."); *see also* Ex. 2021 ¶ 44 (Dr. Dunn's testimony that "[n]umerous well-known publications in the field state that 'Bow River' crude oil has an API gravity of 26.7°."). That value fits squarely within our construction of "less than about 26°," which encompasses API gravity values up to at least 27.6°. Thus, regardless of the alleged geographic differences between the Bow River crude oil disclosed in Eaton and that disclosed in the '118 patent, the alleged difference in years between the sample times, and the alleged seasonal variation in the amounts of diluent in the particular pipelines through which Bow River crude oil flows, the record evidence supports a finding that Bow River crude oil necessarily has an API gravity of "less than about 26°." *See, e.g.*, Ex. 2005, 120 (reporting an API gravity for Bow River heavy crude oil of 26.7° in 1983); Ex. 2006, A–4 (reporting an API gravity for Bow River heavy crude oil of 26.7° at an unspecified date); Ex. 2007, 1 (same); Ex. 2008, 95 (reporting the same API gravity in 1990); Ex. 2009, 106 (reporting an API gravity for Bow River heavy crude oil of 26.7° in 1983); Ex. 2010 (same); Ex. 2017, 1 (July 14, 2014 Product Data Sheet for Patent Owner's EP 1000 product for heavier crude oil reporting an API gravity for Bow River crude oil of 21.8°).[10]

[10] Patent Owner submitted some of the evidence upon which we rely to support our finding that Bow River crude oil inherently has an API gravity of less than about 26°. The Board can rely on such evidence in determining patentability "as long as the patent owner had adequate notice and an adequate opportunity to be heard." *Rovalma, S.A. v. Bohler-Edelstahl GmbH & Co. KG*, 856 F.3d 1019, 1026 (Fed. Cir. 2017). Here, we explained in the Institution Decision that Patent Owner's arguments regarding reported values for the API gravity of Bow River crude oil

Patent Owner's arguments regarding Dr. Dunn's calculations do not persuade us otherwise. *See* Resp. 12 (referring to Dr. Dunn's calculations and asserting that the Bow River crude oil in Eaton's Example 1 was diluted). Dr. Dunn testifies that he "performed calculations" showing that the Bow River crude oil in Eaton's Example 1 "likely was diluted with diluent, because without diluent it generally would have been unsuitable to perform reliable drag reduction testing in a one-inch flow loop using the experimental procedure mentioned in Eaton." Ex. 2021 ¶ 50.

Paragraph 50 of Dr. Dunn's declaration does not include any calculations, but refers to calculations provided in Section VI.B. of Dr. Dunn's declaration. *See id.* Section VI.B of Dr. Dunn's declaration, however, also does not include calculations. *See id.* ¶¶ 53–62. A different section of Dr. Dunn's declaration (that Patent Owner does not cite) includes testimony and calculations Dr. Dunn performed related to drag reduction in Eaton's flow loop experiment. *See id.* ¶ 72.

Dr. Dunn concludes from those calculations that the sample of Bow River crude oil in Eaton would have required "a substantial amount of diluent" to generate the level of turbulence necessary for the flow loop testing. *Id.* But there is no indication in Eaton that the Bow River crude oil (or any hydrocarbon sample) was diluted to achieve turbulent flow. Rather,

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"implicate[d] the claim construction of the phrase 'less than about 26°,'" which the parties had not addressed. Inst. Dec. 17–18. Patent Owner and Petitioner subsequently addressed the claim construction during the course of the proceeding in the Response, Reply, and Sur-Reply. *See* Resp. 4–6; Reply 1–4; Sur-Reply 1–2. Further, as noted above, we questioned Patent Owner about its evidence regarding the API gravity limitation during the oral hearing.

Eaton discloses that a different size flow loop—not dilution—was utilized to achieve turbulent flow of the Bow River crude oil. Ex. 1002, 14:40–42 ("The 1" flow loop was used to test the . . . BOW RIVER crude oil[], which [is] so viscous that [it] do[es] not generate turbulent flow in a ¼" flow loop."); *see id.* at 14:42–55 (describing the flow loop test procedure).[11] We decline to credit Dr. Dunn's testimony over Eaton's explicit disclosure. Accordingly, we determine that Petitioner establishes, by a preponderance of the evidence, that Eaton discloses the API gravity limitation.

b. "introducing a drag reducing polymer, into a pipeline, such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies"

Claim 1 further recites a method comprising "introducing a drag reducing polymer, into a pipeline, such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies." Petitioner contends that Eaton discloses that limitation. Pet. 23–25, 33. Specifically, Petitioner relies on Eaton's description of the invention as one directed to methods of improving the flow of viscous crude oil through pipelines. Pet. 24. Petitioner further points to Eaton's disclosure that the drag reducing polymers of the invention "can produce as much as about thirty percent (30%) or greater flow improvement when added to a hydrocarbon flowing through a conduit." *Id.* (quoting Ex. 1001, 1:66–2:6).

[11] We further find that Dr. Dunn's calculations are based on assumptions that are not supported adequately by the record. For example, Dr. Dunn testifies that "the minimum Reynolds number needed to generate sufficient turbulence for reliable laboratory measurements is 8000," but does not support that statement with any sufficient evidence. Accordingly, we find that Dr. Dunn's testimony on that point is entitled to little or no weight. *See* 37 C.F.R. § 42.65(a).

Petitioner also notes that Eaton explains how its drag reducing polymers "can be introduced into the conduit [i.e., pipeline] to improve flow conditions by reducing frictional pressure losses, or frictionally generated energy bursts, associated with movement of fluid within the conduit." *Id.* (quoting Ex. 1001, 5:8–23) (emphasis omitted); *see* Ex. 1005 ¶ 45.

Patent Owner disagrees with Petitioner's contentions. Resp. 15–21. Patent Owner asserts that Petitioner fails "to identify any evidence that Eaton discloses reducing drag in the flow of an asphaltenic liquid hydrocarbon having an API gravity of less than about 26° in a '**pipeline**[.]'" Resp. 15. Patent Owner further contends that the only disclosures Petitioner cites for introducing a drag reducing polymer into a pipeline "are background passages that do not disclose or suggest a liquid hydrocarbon having an API gravity of less than about 26°," whereas the only disclosure Petitioner cites for the API gravity limitation "does not involve a 'pipeline,'" but rather, involves testing in a flow loop, which is not a pipeline. *Id.* at 15–17.

Patent Owner makes similar arguments with respect to reducing the friction loss associated with the turbulent flow by suppressing the growth of turbulent eddies, i.e., drag reduction. For example, Patent Owner asserts that the passages of Eaton on which Petitioner relies do not disclose the required drag reduction because "none of the passages involve a liquid hydrocarbon with 'an asphaltene content of at least 3 weight percent and an API gravity of less than about 26°' as required by the drag reduction limitation." *Id.* at 19.

Patent Owner's arguments are not directed to whether Eaton discloses introducing a drag reducing polymer into a pipeline such that the friction

loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies. Rather, Patent Owner's arguments are directed to the limitations as arranged or combined in the claim. *See* Resp. 17–18, 21 (asserting that Petitioner improperly combines different aspects of different embodiments in order to arrive at the claimed invention). We address those arguments below, but turn first to whether Eaton discloses the disputed limitation.

After having considered the parties' arguments and the evidence of record, we are persuaded that Petitioner shows, by a preponderance of the evidence, that Eaton discloses "introducing a drag reducing polymer into a pipeline such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies." In particular, Eaton discloses that:

> The present invention is directed to methods of improving the flow of hydrocarbons through conduits, particularly viscous crude oil through pipelines. Surprisingly, it has been discovered that a drag reducing agent (DRA) made in accordance with the methods of this invention can produce as much as about thirty percent (30%) or greater flow improvement when added to a hydrocarbon flowing through a conduit.

Ex. 1002, 1:66–2:6; *see* Pet. 24, 33. Eaton further states that "[a] preferred aspect of the present invention is directed to 'flow increase' or 'drag reduction.'" Ex. 1002, 5:8–9. Eaton goes on to explain that drag reducing agents "reduce drag and increase flow rate of hydrocarbons passing through conduits, particularly crude oil or refined hydrocarbons passing through pipelines." *Id.* at 5:8–13; *see* Pet. 33.

Eaton also describes the mechanism by which the drag reducing agents act—"reducing frictional pressure losses, or frictionally generated

energy bursts associated with movement of fluid within the conduit [i.e., pipeline]." Ex. 1002, 5:13–24, 13:46–48 ("The polyalphaolefin drag reducing agent may be introduced into a conduit to reduce frictional energy losses of the material flowing through the conduit."). On that point, the experts appear to agree. Dr. Epps testifies that the energy bursts Eaton describes "are understood to cause turbulent eddies." Ex. 1005 ¶ 45. And Dr. Dunn testified in the copending litigation that "[t]he only reason anybody would ever inject a DRA [drag reducing agent] into a pipeline would be to suppress the turbulence. That's its method of action." Ex. 1050, 43:20–22; *see also* Ex. 2021 ¶ 64 ("I note that Dr. Epps appears to agree that suppressing the growth of turbulent eddies is the mechanism by which drag reduction occurs."). Finally, Eaton discloses that the flow loop experiment in Example 1 is indicative of the performance of the drag reducing polymers in a commercial setting, i.e., a liquid hydrocarbon, such as Bow River heavy crude oil, flowing through a pipeline:

> Even more surprising, and also indicative of the superior drag reducing capabilities of the present invention in an actual commercial setting, Compositions "A" and "B" both increased the flow rate of BOW RIVER crude oil, while neither compositions "C" nor "D" were able to increase the flow of the BOW RIVER crude oil.

Ex. 1002, 14:62–67; *see* Reply 7. Thus, substantial evidence supports Petitioner's argument that Eaton discloses "introducing a drag reducing polymer into a pipeline such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies."

Patent Owner asserts that, despite Eaton's express disclosure to the contrary, a person of ordinary skill in the art would not have understood that

the flow increases Eaton discloses for compositions A and B of Example 1 amount to a disclosure of "drag reduction achievable in a pipeline." Resp. 20 (citing Ex. 2021 ¶¶ 68–73). According to Patent Owner, this is so because Eaton does not report "any measures of 'drag reduction' in Example 1," in contrast to Eaton's other examples. *Id.*

We agree with Patent Owner that Eaton's Example 1 expresses drag reduction in terms of "percent flow increase," whereas Eaton's Examples 2 and 3 express drag reduction in terms of "percent drag reduction." *Compare* Ex. 1002, Table 1, *with id.* at Tables III–VI. We are not persuaded by Patent Owner's argument that the terms are not equivalent, however, because Eaton states that "percent flow increase" and "percent drag reduction" are alternative quantitative measures of drag reduction. *Id.* at 5:35–6:14; *see also id.* at 5:8–13 ("drag reducing agents reduce drag and increase the flow rate of hydrocarbons passing through conduits"); Reply 8.

Patent Owner asserts that the ordinarily skilled artisan would have understood that the flow increases disclosed in Eaton's Example 1 "likely were caused instead by factors other than drag reduction." Resp. 20 (citing Ex. 2021 ¶¶ 68–69). In support of that argument, Dr. Dunn testifies that the 3.0% and 5.0% flow increases that Eaton observed for Composition A and Composition B, respectively, in the flow loop experiments "could have been caused by reasons other than drag reduction," including "changes in temperature or pressure, or from the experiment being conducted while the fluid was in the transition region characterized by pressure drop fluctuations caused by alternating slugs of laminar flow and turbulence." Ex. 2021 ¶ 68. But Dr. Dunn does not point us to any evidence in the record to support his testimony, which is not only conclusory, but also contrary to Eaton's

disclosure that the tested compositions achieved drag reduction. We decline to credit Dr. Dunn's unsupported testimony over Eaton's express disclosure. *See* 37 C.F.R. § 42.65(a).

Patent Owner also asserts that, although Eaton states the observed flow rate increase is "indicative of the superior drag reducing capabilities" of Composition A and Composition B in a commercial setting (i.e., a pipeline), a person of ordinary skill in the art "would not have understood Eaton to have enabled 'drag reducing capabilities' in a liquid hydrocarbon meeting the API gravity and asphaltene content limitations" of claim 1. Resp. 20 n.7, 21. Dr. Dunn offers similar testimony, opining that "[t]here is no disclosure in Eaton, or any other evidence, to suggest to a [person of ordinary skill in the art] that the results disclosed in Example 1 would show that drag reduction of a heavy, asphaltenic liquid hydrocarbon was achievable by Eaton's polyalphaolefin-based compositions in a pipeline." Ex. 2021 ¶ 76.

To anticipate a claimed invention, a prior art reference must enable one of ordinary skill in the art to make the prior invention without undue experimentation. *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354 (Fed. Cir. 2003). Factors considered in making that determination include:

> (1) the quantity of experimentation necessary, (2) the amount of direction or guidance present, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988).

A prior art patent like Eaton, however, is presumptively enabled as to both claimed and unclaimed materials disclosed therein, and the burden of

proving that it is not enabled rests with Patent Owner. *In re Antor Media Corp.*, 689 F.3d 1282, 1287–88 (Fed. Cir. 2012); *Impax Labs., Inc. v. Aventis Pharms., Inc.*, 545 F.3d 1312, 1316 (Fed. Cir. 2008).

Here, Patent Owner merely states in conclusory fashion that Eaton does not enable "'drag reducing capabilities' in a liquid hydrocarbon meeting the API gravity and asphaltene content limitations" that claim 1 recites. Resp. 20 n.7, 21. Dr. Dunn's testimony on that point also is conclusory. Neither Patent Owner nor Dr. Dunn provides a *Wands* factor analysis, or directs us to evidence showing sufficiently that it would require undue experimentation to achieve drag reduction of a heavy, asphaltenic liquid hydrocarbon using Eaton's exemplary polymers in a pipeline. Thus, Patent Owner fails to demonstrate that Eaton is not enabled.

Finally, as indicated above, Patent Owner contends that Petitioner fails to carry its burden of showing that Eaton discloses reducing drag in the flow of an asphaltenic liquid hydrocarbon having an API gravity of less than about 26° in a pipeline, i.e., the limitations as arranged in claim 1, because Petitioner "'pick[s] and choose[s]' different aspects of different embodiments" in order to arrive at the claimed arrangement. *Id.* at 15, 18 (citing *Net MoneyIN*, 545 F.3d at 1369–71; *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972)), 21. We are not persuaded.

"[A] reference can anticipate a claim even if it 'd[oes] not expressly spell out' all of the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would 'at once envisage' the claimed arrangement or combination." *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1341 (quoting *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015)). That is, "a reference need not

always include an express discussion of the actual combination to anticipate." *Id.* at 1344 (citing *Kennametal*, 780 F.3d at 1383).[12]

We find that a person of ordinary skill in the art, reading Eaton, would immediately envisage introducing Eaton's polymers into a pipeline through which a liquid hydrocarbon meeting the recited asphaltene content and API gravity is flowing, in order to reduce drag. In particular, we note that Eaton is "directed to methods of improving the flow of hydrocarbons through conduits, *particularly viscous crude oil flowing through pipelines*." Ex. 1002, 1:66–2:1 (emphasis added). Eaton states that its drag reducing polymers have "surprisingly superior drag reducing properties when combined with crude oil that is flowing through *a pipeline* or other conduit." *Id.* at 2:23–25 (emphasis added); *see also id.* at 2:1–6 ("Surprisingly, it has been discovered that a drag reducing agent (DRA) made in accordance with the methods of this invention can produce as much as about thirty percent (30%) or greater flow improvement when added to a hydrocarbon flowing through a conduit."), 5:37–41 ("when combined in sufficient quantities with a hydrocarbon flowing through a conduit, the DRA of this invention provides a flow increase that is superior to the flow increases provided by other commercially available DRAs"). Eaton further discloses that, during the polymerization process, a portion of the oligomers and polyalphaolefin

[12] In *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 851 F.3d 1270, 1274-75 (Fed. Cir. 2017), the Federal Circuit explained that "*Kennametal* does not stand for the proposition that a reference missing a limitation can anticipate a claim if a skilled artisan viewing the reference would 'at once envisage' the missing limitation." 851 F.3d at 1274. Here, we do not find that Eaton is missing a limitation that an ordinary artisan would immediately envisage. Rather, we address whether an ordinary artisan would at once envisage the claimed arrangement.

polymers are mixed with a hydrocarbon solvent that "enhances the ability of the DRA to become incorporated or dissolved into the hydrocarbon[], e.g., *the crude oil in a pipeline*." *Id.* at 10:36–47 (emphasis added).

Eaton describes tests of four different drag reducing polymers performed to compare "their ability to increase [the] flow of various hydrocarbons," including Bow River crude oil—a hydrocarbon that satisfies the asphaltene content and API gravity limitations of the challenged claims. *Id.* at 13:57–15:24. Although Eaton's tests were conducted in a laboratory setting using a flow loop, Eaton states that the test results are "indicative of the superior drag reducing capabilities of the present invention in an actual commercial setting." *Id.* at 14:62–64. At the oral hearing, counsel for Patent Owner suggested that when Eaton states "commercial setting" "they are saying look at the lab results we got compared to the commercial products out there." Tr. 46:5–12; *see id.* 45:22–46:2. We do not agree and determine, based on the entirety of Eaton's disclosure, that the reference to "commercial setting" means use in a pipeline. Thus, Eaton explicitly teaches using its drag reducing agents in a liquid hydrocarbon, such as Bow River crude oil, flowing through a pipeline. Accordingly, we are not persuaded by Patent Owner's argument that Petitioner's analysis picks and chooses or combines unrelated disclosures in order to arrive at the claimed invention.

In sum, we are persuaded that Petitioner shows, by a preponderance of the evidence, that Eaton discloses "introducing a drag reducing polymer into a pipeline such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies."

c. The solubility parameter limitation

Claim 1 also recites the solubility parameter limitation (i.e., wherein the drag reducing polymer has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of the liquid hydrocarbon). Petitioner acknowledges that Eaton does not expressly disclose the solubility parameters of the drag reducing polymers in Example 1 (i.e., Compositions A and B). Pet. 31. Notwithstanding that acknowledgement, Petitioner asserts that Eaton's disclosure of the polymers is a disclosure of all the properties of those polymers, even those properties that are not disclosed expressly. *Id.* (citing *In re Papesch*, 315 F.2d 381, 391). Petitioner supports its assertions with Dr. Epps's calculations of Eaton's Composition A and Composition B solubility parameters, as well as Dr. Epps's explanation regarding how an ordinarily skilled artisan would have understood and applied the solubility relationships described in Strausz to Eaton's polymers and Bow River crude oil. *Id.* at 31–32 (citing Ex. 1005 ¶¶ 68–74).

Patent Owner disagrees. Patent Owner contends that Dr. Epps's testimony regarding solubility parameters and how Strausz's teachings apply to Eaton's polymers and Bow River crude oil "proceed from the same faulty premise: that the solubility parameter of the 'Bow River' sample in Eaton can be calculated using the range of solubility parameters disclosed in Strausz for solvents in which certain asphaltenes [i.e., different substances] are 'completely soluble.'" Resp. 22–23. Similarly, Patent Owner argues that Dr. Epps's testimony about solubility is unsupported, contrary to Strausz, and testimony that Dr. Epps later admitted is not correct. *Id.* Patent Owner also contends that Dr. Epps assumes, without factual support, that one can derive information about Bow River crude oil from Strausz's

analysis of Athabasca bitumen, "an entirely different substance" with different asphaltenes than the Bow River crude oil. *Id.* at 23 (citing Ex. 2021 ¶¶ 82–8; Ex. 2037, 9; Ex. 2022, 112:3–11, 120:5–15; Ex. 2097, 171). Finally, Patent Owner contends that Dr. Epps's quantification of the relationship between the solubility parameters of Eaton's Compositions A and B "also is unsupported and incorrect." Resp. 23–25.

After having reviewed the parties' arguments and evidence, we find that Petitioner shows, by a preponderance of the evidence, that Eaton discloses the solubility parameter limitation. Both Dr. Epps and Dr. Dunn agree that the purpose of solubility parameters is to predict the solubility of one material in another. Ex. 1005 ¶ 32; Ex. 1043, 42:1–2 (Dr. Dunn's testimony that "[s]olubility parameters are a predictor of solubility of one material in another"). Dr. Epps and Dr. Dunn also agree that a polymer cannot reduce drag unless it is soluble in the crude oil it is meant to treat. Ex. 1005 ¶ 73 ("solubility is necessary for drag reduction"); Ex. 1043, 29:21–22 ("Solubility of the polymer is one requirement for a polymer to serve as a drag-reducing polymer."); *see also* Ex. 1001, 1:39–41 ("In general, drag reduction depends in part upon the molecular weight of the additive and its ability to dissolve in the hydrocarbon under turbulent flow."). Indeed, Dr. Dunn testified in the copending litigation that Patent Owner knew Petitioner's drag reducing polymer formulation has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of certain heavy crude oils because Petitioner's drag reducing polymer "treated" the heavy crude oils, i.e., reduced drag in the crude oil flowing through the pipeline:

> Q. . . . Does LSPI have any evidence that Baker Hughes knew that the solubility parameters of its formulation were within 4 megapascals to the one half power [$MPa^{1/2}$] of the solubility

> parameters of any hydrocarbon its formulation has been injected into?
>
> . . .
>
> A. I would say that the '118 patent contains a table, table 1, I believe, which lists some of the crude oil parameters, including those of Western Canadian Select. And the context of the -- the content of the patent also contains a reference to The Chemistry of the Alberta Oil Sands, Bitumens and Heavy Oils.
>
> Q. . . . Okay. Where do you see that?
>
> A. That's in column 4, number 32, 31 and 32. And within -- within that reference is -- are the solubility parameters of -- of heavy oils, in particular heavy oils from Canada, and that the range is called out in the patent. So, any -- any treating of a -- of a heavy Canadian crude oil would -- would be assumed to be an infringing use.

Ex. 1050, 71:23–72:18.[13] Thus, Dr. Dunn admits that treating (i.e., drag reducing) a heavy crude oil means that the polymer necessarily is soluble in that heavy crude oil and necessarily has a solubility parameter within 4 $MPa^{1/2}$ of the solubility parameter of heavy crude oil. As discussed above, Eaton discloses that Compositions A and B successfully treated (i.e., reduced drag and increased flow of) Bow River crude oil. *See supra* § II.D.2.b. Accordingly, we find that Eaton's Compositions A and B necessarily have solubility parameters within 4 $MPa^{1/2}$ of the solubility parameter of Bow River crude oil.

We also credit Dr. Epps's testimony regarding the solubility relationships that Strausz describes, and how those relationships apply to hydrocarbons, such as asphaltenes, crude oil, and drag reducing polymers. Ex 1005 ¶¶ 68–73. For example, Dr. Epps testifies that the person of

[13] Citations to Exhibit 1050 are to the exhibit's original pagination.

ordinary skill in the art would have understood the numerical relationships Strausz discloses for asphaltenes in Table 14.2 and the accompanying text to apply to other hydrocarbons because "the solubility parameters of the hydrocarbons can be estimated using only the dispersive interactions" and Strausz indicates that such interactions "are translatable across systems." *Id.* ¶ 72 (citing Ex. 1003, 466). Dr. Epps also explains how an ordinarily skilled artisan would have understood from those numerical relationships that Eaton's Compositions A and B must be at least reasonably soluble in Bow River crude oil and, therefore, must have solubility parameters that are within about 3.5 $MPa^{1/2}$ of the solubility parameter of the crude oil. Ex. 1005 ¶¶ 71–74.

In this proceeding, Dr. Dunn disagrees with Dr. Epps's opinions about the relationships Strausz discloses and how one of ordinary skill in the art would apply them to Bow River crude oil or Eaton's polymers. Ex. 2021 ¶¶ 79–83. In the copending litigation, however, Dr. Dunn testified that Strausz teaches the solubility parameters for heavy crude oils from Canada, like Bow River crude oil. Ex. 1050, 72:19–73:9. Given that testimony, we are not persuaded by Patent Owner's arguments that Petitioner and Dr. Epps fail to support the assertion that an ordinarily skilled artisan can derive information about Bow River crude oil from Strausz's analysis of Athabasca bitumen, even if they are different substances with different asphaltenes. Resp. 23; *see also* Ex. 2011, 461 (Strausz indicating that a "close compositional and structural similarity" exists between asphaltenes from "a variety of different sources"). Likewise, we do not find Dr. Epps's testimony regarding solubility generally, or the solubility parameters of Bow

River crude oil and Eaton's polymers specifically, "unsupported," as Patent Owner argues. *See id.* at 22–25.

Patent Owner also points to certain testimony Dr. Epps provided in other *inter partes* review proceedings involving patents related to the '118 patent. Resp. 22–23. Patent Owner contends that testimony is inconsistent with Dr. Epps's testimony in this case. *Id.* We do not agree. Rather, we agree with Petitioner that Dr. Epps's testimony is consistent between the proceedings and consistent with the terminology Strausz employs. Reply 9–10. For example, as Dr. Epps testifies, Strausz "refers to the *dispersion* of asphaltenes in terms of *solubility*" and considers asphaltene to be solubilized in a particular solvent if it does not precipitate. *See, e.g.*, Ex. 1003, 466 (explaining that solubility parameters apply to asphaltenes even though such materials technically are colloidal dispersions), 467 (noting that asphaltene is "completely soluble" in hydrocarbon solvents having a solubility parameter that is greater than or equal to 17.1 $MPa^{1/2}$); Ex. 1046 ¶¶ 28–30. In other words, for the purposes of explaining the solubility parameters and relationships, Strausz does not draw a relevant distinction between "soluble" and "dispersed."

In sum, we find that Petitioner shows, by a preponderance of the evidence, that Eaton inherently discloses the solubility parameter limitation.

d. Additional limitations

Petitioner contends that Eaton discloses the remaining limitations of claim 1, and the additional limitations of claims 3, 4, 6, 7, and 11. Pet. 27–40. For example, Petitioner explains how Eaton inherently discloses that the viscosity of the treated liquid hydrocarbon is not less than the viscosity of the liquid hydrocarbon prior to treatment with the drag reducing polymer.

Pet. 27–31 (citing Ex. 1002, 11:43–67, 14:7–31; Ex. 1005 ¶¶ 50–56; Ex. 1010; Ex. 1032). Petitioner also shows that Eaton discloses adding the drag reducing polymer to the liquid hydrocarbon at a concentration of 1 to 250 ppmw—a concentration within the range of 0.1 to about 500 ppmw recited in claim 1. *Id.* at 32 (citing Ex. 1002, 2:6–9, 35–40, 15:1–12). Petitioner also explains how Eaton discloses the additional limitations of claims 3, 4, 6, 7, and 11. *Id.* at 37–40 (citing Ex. 1002, 14:13–19, 26–31, 6:15–36; Ex. 1005 ¶¶ 34–35, 58, 62–63, 66–69).

Patent Owner does not address the merits of Petitioner's assertions regarding those limitations. *See generally* Resp. In the Scheduling Order, we cautioned Patent Owner that any arguments for patentability not raised in the Response would be deemed waived. Paper 10, 3; *see also* 37 C.F.R. § 42.23(a) ("Any material fact not specifically denied may be considered admitted."). After having reviewed the unrebutted arguments and evidence presented by Petitioner concerning the remaining limitations of claim 1 and the additional limitations of claims 3, 4, 6, 7, and 11, we are persuaded by those arguments, which we adopt as our own. *See* Pet. 27–31, 32, 35–40; Ex. 1002, 2:6–9, 2:35–40, 6:15–36, 11:43–67, 14:7–31, 15:1–12; Ex. 1005 ¶¶ 34–35, 50–56, 58, 62–63, 66–69; Ex. 1010; Ex. 1032; *see also In re Nuvasive*, 841 F.3d 966, 974 (Fed. Cir. 2016) (explaining that the Board need not make specific findings as to claim limitations that Patent Owner does not dispute are disclosed in the prior art). Accordingly, we find that a preponderance of the evidence establishes that Eaton discloses those elements of claims 1, 3, 4, 6, 7, and 11.

3. Conclusion

Based on our review of the record arguments and evidence, and for the foregoing reasons, we determine that Petitioner establishes, by a preponderance of the evidence, that Eaton anticipates claims 1, 3, 4, 6, 7, and 11 of the '118 patent.

E. Ground 2: Obviousness of Claims 1–7 and 11 over Eaton and Strausz

Petitioner argues that the combination of Eaton and Strausz would have rendered the subject matter of claims 1–7 and 11 obvious to a person of ordinary skill in the art. Pet. 40–47. Patent Owner disagrees. Resp. 26–62. Based on our review of the arguments and evidence of record, we determine that Petitioner demonstrates, by a preponderance of the evidence, that the subject matter of claims 1–7 and 11 would have been obvious over the combination of Eaton and Strausz, as explained below.

1. Legal standards

A patent claim is unpatentable under 35 U.S.C. § 103(a) if 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 to a person of ordinary skill in the art at the time the invention was made. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on 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) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

2. The prior art discloses or suggests each and every element of claims 1–7 and 11

Petitioner asserts that the combined teachings of Eaton and Strausz disclose or suggest each element of claims 1–7 and 11. Pet. 40–45 (citing Ex. 1005 ¶¶ 32, 41, 81–93). For all of the limitations of claim 1, except the solubility parameter limitation, and the additional limitations of claims 3, 4, 6, and 7, Petitioner relies on the same arguments and evidence addressed previously in connection with Petitioner's assertion that Eaton anticipates those claims. *Id.* at 40. For the solubility parameter limitation, however, Petitioner relies on the combination of Eaton and Strausz, more specifically, Strausz's disclosure of solubility parameters as properties "commonly used to assess the solubility of one material in another." *Id.* at 41 (citing Ex. 1005 ¶ 32).[14] Petitioner contends that even without calculating the solubility parameters of Eaton's Compositions A and B (as Petitioner and Dr. Epps did for Ground 1), claims 1–7 and 11 would have been obvious to the ordinary artisan. *Id.*

Specifically, Petitioner asserts that the solubility parameter limitation "simply teaches one of ordinary skill in the art that the drag reducing polymer was predicted to be soluble in the liquid hydrocarbon." *Id.* (citing Ex. 1005 ¶ 32). Petitioner also relies on Dr. Epps's testimony that "the more soluble a drag reducing polymer is in the fluid being treated, the greater its effectiveness." *Id.* (citing Ex. 1005 ¶ 41). Thus, according to Petitioner, a person of ordinary skill in the art would have understood from the combined teachings of Eaton and Strausz that the solubility parameter of Bow River

[14] As explained above, we determine that Eaton inherently discloses the solubility parameter limitation. Thus, we consider Petitioner's reliance on Strausz for this ground as an alternative argument.

crude oil "lies between about 17.1 $MPa^{1/2}$ and about 19.6 $MPa^{1/2}$," and would have been prompted to prepare a drag reducing polymer within that solubility parameter range in order to effectively treat the Bow River crude oil. *Id.* at 42 (citing Ex. 1005 ¶¶ 81–84).

Dr. Epps testifies that preparing such a drag reducing polymer would have been routine, requiring the ordinarily skilled artisan to (a) identify from published solubility parameter information "a desirable homopolymer or copolymer" having a solubility parameter within the target 17.1–19.6 $MPa^{1/2}$ range and (b) perform the polymerization reaction that Eaton describes under conditions suitable to obtain the desired polymer. Ex. 1005 ¶¶ 85–92; *see* Pet. 42–43. Dr. Epps provides example polymers that he asserts one of ordinary skill in the art would have prepared from Eaton's disclosure by applying the target solubility parameter based on Strausz's disclosed relationships. Ex. 1005 ¶¶ 85–92.

Petitioner applies the same teachings to the solubility parameters recited in claims 2 and 5, i.e., a drag reducing polymer having a solubility parameter of "at least about 17 $MPa^{1/2}$" and a drag reducing polymer having a solubility parameter "within 2.5 $MPa^{1/2}$ of the liquid hydrocarbon," respectively. Pet. 44–45 (citing Ex. 1005 ¶¶ 85–92).

Patent Owner disagrees with Petitioner's assertions and argues that the combination of Eaton and Strausz fails to teach the API gravity limitation, introducing the drag reducing polymer into a pipeline, and the solubility parameter limitation of claims 1–7 and 11 "for the same reasons discussed" with respect to Ground 1 (anticipation by Eaton). Resp. 52. As discussed above, we find that Eaton either expressly or inherently discloses

those limitations. *See supra* § II.D.2.a–c. Accordingly, we are not persuaded by Patent Owner's arguments to the contrary.

Moreover, regarding the solubility parameter limitation, we are persuaded by Petitioner's argument and Dr. Epps's testimony that the combination of Eaton and Strausz suggests drag reducing polymers having the solubility parameter limitation, because the solubility parameter limitation merely states what one of ordinary skill already knew and would have applied—that the drag reducing polymer must be soluble in the liquid hydrocarbon. *See* Pet. 41; Ex. 1005 ¶ 32. We also credit Dr. Epps's testimony setting forth how one of ordinary skill in the art, knowing the target solubility parameter of the liquid hydrocarbon (e.g., for Bow River crude oil, a range of 17.1–19.6 $MPa^{1/2}$), would have consulted the literature or used calculations to determine which of Eaton's homopolymers or copolymers would provide a solubility parameter within the target range, and then used Eaton's disclosed methods to prepare that polymer or polymers. Ex. 1005 ¶¶ 81–92 (citing Ex. 1002, 9:8–18; Ex. 1003, 465–467; Ex. 1007, VII-686, VII-707; Ex. 1012, 1025; Ex. 1037, 252–253). Accordingly, Petitioner establishes, by a preponderance of the evidence, that the combined teachings of Eaton and Strausz disclose the solubility parameter limitation of the challenged claims.

Patent Owner also argues that Petitioner fails to demonstrate that the combined teachings of Eaton and Strausz disclose or suggest a polymer or polymers that would reduce drag in a hydrocarbon having the required asphaltene content and API gravity. Resp. 52–53. In particular, Patent Owner contends that Eaton did not test any of the polymers that Dr. Epps identifies (i.e., a polystyrene polymer or a poly(ethylene/styrene)

copolymer), or suggest that the results set forth in Example 1 would have been understood to apply to different polymers than those tested. *Id.* (citing Ex. 2021 ¶ 96). Patent Owner further points to Dr. Epps's deposition, during which he offered no opinion as to whether any specific polymer made using Eaton's process would actually cause drag reduction in a heavy asphaltenic crude oil. *Id.* at 53 (citing Ex. 2022, 46:25–47:22, 52:10–14, 147:15–21). According to Patent Owner, Dr. Epps's testimony is "fatal" to Petitioner's grounds. *Id.*

With respect to the combination of Eaton and Strausz, Patent Owner asserts that "establishing that a polymer has a solubility parameter that is within a certain range of the solubility parameter of a crude oil is not sufficient," on its own, "to show that the polymer will dissolve, let alone reduce drag, in the flow of that oil through a pipeline." *Id.* at 53–54 (citing Ex. 2021 ¶¶ 101–105). On that point, Patent Owner refers to Eaton's disclosure of a polymer (Composition "C") that has a solubility parameter within 4 $MPa^{1/2}$ of Dr. Epps's calculated Bow River solubility parameter, but does not reduce drag. *Id.* at 54. Patent Owner further asserts that "drag reduction requires more than a mere solubility parameter match," including a specific structure, a high molecular weight, and shear resistance. *Id.* at 54 (citing Ex. 1005 ¶¶ 38–39; Ex. 2022, 26:23–27:8, 48:16–49:4 (Dr. Epps's testimony regarding conditions for drag reduction), 60. In other words, Patent Owner characterizes Petitioner's argument as one that is based on solubility parameters alone, and contends that more is required for the combined teachings of Eaton and Strausz to suggest that the polymer will reduce drag.

We are not persuaded by Patent Owner's arguments because they are based on the premise that Petitioner relies on solubility parameters alone to argue that the combined teachings of Eaton and Strausz disclose drag reduction. Petitioner's arguments, however, are not based on solubility parameters alone, but also on Eaton's teaching that polymers made using its process are drag reducing polymers. Thus, Petitioner's arguments take into account not only that a drag reducing agent would reduce drag, but also that it would possess the properties associated with drag reduction, such as straight chain structure, high molecular weight, and shear resistance. Reply 14–15; Ex. 1056 ¶¶ 54–57.

Further, we find that the combined teachings of Eaton and Strausz suggest that the polymers Dr. Epps identifies would reduce drag. First, Eaton describes its polyalphaolefin polymers as "drag reducing polymers," thereby indicating that the polymers would possess the other properties associated with drag reduction. *See, e.g.*, Ex. 1002, Abstract ("A composition including polyalphaolefins that function as drag reducing agents and a process for the preparation of polyalphaolefins that function as drag reducing agents are disclosed. . . . [A] process for reducing drag in a conduit [is] also disclosed."). Second, Petitioner and Dr. Epps, applying the relationships Strausz describes, identify polymers within Eaton's disclosure (polystyrene and poly(ethylene/styrene)) that have solubility parameters falling within the solubility parameter range of Bow River crude oil (i.e., a range of 17.1–19.6 $MPa^{1/2}$). Pet. 42–43; Ex. 1005 ¶¶ 83–92. Those polymers are a better solubility match than the Composition A and Composition B polymers, which have solubility parameters of 16.31, and

16.11, respectively.[15] Ex. 1005 ¶¶ 66–67. Third, Petitioner argues persuasively that solubility in the fluid being treated was known to be one of the most important requirements for a drag reducing polymer and a predictor of successful drag reduction. Pet. 42; Ex. 1005 ¶ 41; Ex. 1008, 800 ("Drag reduction effectiveness of a polymer is greater in thermodynamically 'good' solvents and is smaller in 'poor' solvents."); Ex. 1009, 1550 (describing solubility in the liquid hydrocarbon as "the most important requirement" for a drag reducing polymer); *see* Ex. 1001, 1:39–41 (Description of the prior art stating "[i]n general, drag reduction depends in part upon the molecular weight of the polymer additive and its ability to dissolve in the hydrocarbon under turbulent flow"). Given the foregoing, we find that Petitioner establishes, by a preponderance of the evidence, that the combined teachings of Eaton and Strausz disclose or suggest that polymers within Eaton's disclosure (polystyrene and poly(ethylene/styrene)) would have reduced drag in a liquid hydrocarbon having the recited asphaltene content and API gravity, such as Bow River crude oil.

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[15] As noted above, Patent Owner contends that Eaton's Composition C has a solubility parameter within 4 $MPa^{1/2}$ of Dr. Epps's calculated Bow River crude oil solubility parameter, but does not reduce drag. Resp. 54 (citing Ex. 2021 ¶ 103). Dr. Dunn testifies that Eaton's Composition C is LP 100 FLOW IMPROVER, which the '118 patent states has a solubility parameter of 16.49 $MPa^{1/2}$. Ex. 2021 ¶ 103; Ex. 1001, 14:6–10. Eaton, however, states that Composition C is "LIQUID POWER commercial DRA from Conoco Inc," Ex. 1002, 15:11, and neither Petitioner nor Dr. Dunn establishes that LP 100 FLOW IMPROVER is the same commercial product (or polymer composition) as LIQUID POWER commercial DRA from Conoco Inc. Dr. Dunn assumes that both references are to the same product, but does not provide any evidence, such as a product specification sheet, to support that assumption. Thus, we are not persuaded by Patent Owner's argument regarding Composition C.

Accordingly, based on the full trial record, Petitioner establishes, by a preponderance of the evidence, that the collective teachings of Eaton and Strausz disclose or suggest each limitation of claims 1–7 and 11.

3. Rationale for combining the teachings of Strausz and Eaton and reasonable expectation of success

Even "[i]f all elements of the claims are found in a combination of prior art references," "the factfinder should further consider whether a person of ordinary skill in the art would [have been] motivated to combine those references, and whether in making that combination, a person of ordinary skill would have [had] a reasonable expectation of success." *Merck & Cie v. Gnosis S.P.A.*, 808 F.3d 829, 833 (Fed. Cir. 2015). The "motivation to combine" and "reasonable expectation of success" factors are subsidiary requirements for obviousness subsumed within the *Graham* factors. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007).

Petitioner argues that an ordinarily skilled artisan would have been prompted to combine the teachings of Eaton and Strausz in order to make a more effective drag reducing polymer for Bow River crude oil, i.e., to address a problem that Eaton identified with existing drag reducing polymers. Pet. 46–47. In particular, Petitioner states that a person of ordinary skill would have understood from Eaton's Example 1 that Eaton's polymers successfully reduced drag in Bow River crude oil, a heavy, high-asphaltene crude oil. *Id.* Petitioner further asserts that the skilled artisan would have understood from Strausz's disclosed relationships and the solubility parameters of Eaton's exemplary compositions that a polymer having a solubility parameter within range of Bow River crude oil (i.e., 17.1–19.6 $MPa^{1/2}$) would be most soluble in the Bow River crude oil and, therefore, more effective as a drag reducer. *Id.* at 42 (citing Ex. 1005 ¶¶ 81–

84), 46. Thus, Petitioner asserts that the person of ordinary skill in the art would have combined the teachings of Eaton and Strausz to prepare a drag reducing polymer that is more effective in the claimed hydrocarbon than the polymers tested in Eaton's Example 1. *Id.* at 46.

Petitioner further argues that an ordinary artisan, following the combined teachings of Eaton and Strausz, would have reasonably expected a polymer having a solubility parameter close to that of Bow River crude oil (i.e., one that dissolves in the Bow River crude oil) to reduce frictional pressure losses in the Bow River crude oil (i.e., reduce drag). *Id.* at 47 (citing Ex. 1005 ¶ 94).

Patent Owner contends that Petitioner's reason for combining the teachings of Eaton and Strausz is based on hindsight. Resp. 56. In making that argument, Patent Owner reiterates its position that the person of ordinary skill in the art would not have consulted Strausz or used the relationships Strausz sets forth to improve upon traditional drag reducing polymers. *Id.* at 56, 58. Patent Owner also contends, again, that Strausz "concerns the chemistry of bitumen" and does not have anything to do with drag reduction or drag reducing polymers. *Id.* at 56–57. Patent Owner further urges us to adopt Dr. Dunn's definition of the level of ordinary skill in the art—a definition that omits Strausz from the knowledge of the ordinary artisan. *Id.* at 57. Finally, Patent Owner asserts that Strausz's relevance to the problems of drag reducing polymers "was an inventive aspect of the 118 Patent." *Id.* at 58 (citing *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1353 (Fed. Cir. 2013); *Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1377 (Fed. Cir. 2012)), 61–62.

With respect to Strausz, as we explain in Section II.A, *supra*, one of ordinary skill in the art seeking to improve upon conventional drag reducing polymers would have consulted such a publication. But, to the extent Patent Owner's argument is really an argument that Strausz is non-analogous art—an argument not made with clarity in Patent Owner's Response—we address this argument below.

To rely upon a reference as a basis for unpatentability, the reference must either (1) be in the field of the inventor's endeavor or (2) be reasonably pertinent to the particular problem with which the inventor was concerned. *In re Oetiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992). In determining whether a reference is reasonably pertinent to the problem, "[i]t is necessary to consider 'the reality of the circumstances' . . . in other words, common sense." *Id.* (quoting *In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979)). That is, "[r]eferences are selected as being reasonably pertinent to the problem based on the judgment of a person having ordinary skill in the art." *In re Kahn*, 441 F.3d 977, 987 (Fed. Cir. 2006) (citing *Oetiker*, 977 F.2d at 1447).

Here, we find that Strausz is at least reasonably pertinent to one of the problems confronting the inventors of the '118 patent. As explained above, it was known prior to the '118 patent that solubility of the drag reducing polymer in the liquid hydrocarbon was necessary to achieve drag reduction, and an important requirement in preparing a more effective drag reducing polymer. Ex. 1005 ¶ 41; Ex. 1008, 800–802; Ex. 1009, 1550; *see* Ex. 1001, 1:39–41; Ex. 1043, 29:21–22. Thus, the inventors of the '118 patent would have been concerned about whether the drag reducing polymer was soluble in the liquid hydrocarbon they were using the polymer to treat. Strausz, which discloses solubility relationships that one of ordinary skill in the art

would have applied to hydrocarbons, is reasonably pertinent to that problem. *See* Reply 15–16.

As to Patent Owner's argument that utilizing the relationships Strausz discloses was part of the inventive aspect of the '118 patent because the inventors were the first to recognize that asphaltene content impacts the potential for drag reduction of the recited liquid hydrocarbons, we are not persuaded. We also are not persuaded that Petitioner used the invention to define the problem that the invention solves, which Patent Owner identifies as recognizing that "asphaltene content impacts the potential for drag reduction of the claimed liquid hydrocarbons in a way that was previously unrecognized." Resp. 59. As support, Patent Owner points to the examples disclosed in the '118 patent. *Id.* (citing Ex. 1001, 14:15–18:25, Table 1). Those examples, however, do not correlate drag reduction to asphaltene content, or indicate the importance of asphaltene content to the challenged claims. Instead, the '118 patent describes Strausz as a resource for determining the solubility parameter of the liquid hydrocarbon. Ex. 1001, 4:20–34. Moreover, the problem that the '118 patent seeks to address is reducing drag in crude oils having a low API gravity and/or a high asphaltene content (i.e., heavy crude oils)—a problem that was known in the art. Ex. 1001, 1:44–49. Thus, the present case is distinguishable from *Leo Pharmaceutical* and *Mintz*—cases in which the inventors recognized and solved a problem that the prior art failed to recognize.

Turning back to Petitioner's proffered rationale for combining the teachings of Eaton and Strausz, we are persuaded that one of ordinary skill in the art seeking a drag reducing polymer that is maximally effective at reducing the frictional pressure losses in Bow River crude oil (as Eaton aims

to do) would have taken advantage of the solubility relationships that Strausz discloses to identify a homopolymer or copolymer in Eaton having a solubility parameter that is closer to the solubility parameter of Bow River crude oil (i.e., within the range of 17.1–19.6 $MPa^{1/2}$) than the polymers disclosed in Eaton's examples, and prepare that polymer. In other words, we agree with Petitioner that one of ordinary skill in the art seeking to maximize the effectiveness of the drag reducing polymer would have chosen one of Eaton's disclosed homopolymers or copolymers having a solubility parameter within the solubility parameter range of Bow River crude oil based on Strausz's disclosed relationships. In making this determination, we credit Dr. Epps's supporting testimony and the evidence of record demonstrating that solubility of the drag reducing polymer in the liquid hydrocarbon is one of the most important requirements for achieving drag reduction. *See* Pet. 46–47; Ex. 1005 ¶¶ 41, 94; Ex. 1008, 800; Ex. 1009, 1550; *see* Ex. 1001, 1:39–41; Ex. 1004, 1:39–47.

As to whether Petitioner demonstrates a reasonable expectation of success in combining the teachings of Eaton and Strausz to meet the limitations of the challenged claims, the parties' dispute centers on whether the person of ordinary skill in the art would have reasonably expected the polymers other those in Eaton's Example 1 to meet the limitations of the challenged claims, specifically reducing drag. *See* Pet. 46; Resp. 52–54. Petitioner contends that the person of ordinary skill in the art would have reasonably expected a polymer prepared by following the combined teachings of Eaton and Strausz to have "desirable properties, including the claimed solubility parameter relationship," and to reduce frictional pressure

losses in Bow River heavy crude oil (i.e., a hydrocarbon having the recited asphaltene content and API gravity). Pet. 46 (citing Ex. 1005 ¶ 94).

Patent Owner counters that a skilled artisan would not have expected the polymers Petitioner and Dr. Epps identify to reduce drag in the claimed heavy, asphaltenic liquid hydrocarbons merely because they have a solubility parameter that is within a specific target range. Resp. 52–54, 60, 62. Patent Owner points to the fact that Eaton did not test any of the polymers that Dr. Epps identifies (i.e., a polystyrene polymer or a poly (ethylene/styrene) copolymer), or suggest that the results set forth in Example 1 would have been understood to apply to different polymers than those tested. *Id.* at 52–53 (citing Ex. 2021 ¶ 96). Patent Owner also notes that Dr. Epps offered no opinion as to whether any specific polymer made using Eaton's process would actually cause drag reduction in a heavy asphaltenic crude oil, which is "fatal" to Petitioner's grounds. *Id.* at 53 (citing Ex. 2022, 46:25–47:22, 52:10–14, 147:15–21).

Patent Owner further asserts that "establishing that a polymer has a solubility parameter within a certain range of the solubility parameter of a crude oil is not sufficient," on its own, "to show that the polymer will dissolve, let alone reduce drag, in the flow of that oil through a pipeline." *Id.* at 53–54 (citing Ex. 1005 ¶¶ 38–39; Ex. 2022, 26:23–27:8, 48:16–49:4; Ex. 2021 ¶¶ 101–105, and referring to Eaton's Composition C, which has a solubility parameter within 4 $MPa^{1/2}$ of Dr. Epps's calculated Bow River solubility parameter, but does not reduce drag in heavy, asphaltenic crude oil). Patent Owner also points experiments Dr. Dunn conducted, which Patent Owner contends demonstrate that polystyrene, one of Dr. Epps's

identified polymers from Eaton's disclosure, "does not even dissolve in Bow River crude oil, let alone reduce drag in it." *Id.* at 54.

We are not persuaded by Patent Owner's arguments for the same reasons expressed in Section II.E.2. For example, as we explain above, Eaton describes its polyalphaolefin polymers as "drag reducing polymers," thereby indicating that the polymers would possess all of the properties associated with drag reduction. *See, e.g.*, Ex. 1002, Abstract ("A composition including polyalphaolefins that function as drag reducing agents and a process for the preparation of polyalphaolefins that function as drag reducing agents are disclosed. . . . [A] process for reducing drag in a conduit [is] also disclosed.").

Further, Petitioner argues persuasively that solubility in the fluid being treated was known to be one of the most important requirements for a drag reducing polymer, and a predictor of successful drag reduction. Pet. 42; Ex. 1005 ¶ 41; Ex. 1008, 800 ("Drag reduction effectiveness of a polymer is greater in thermodynamically 'good' solvents and is smaller in 'poor' solvents."); Ex. 1009, 1550 (describing solubility in the liquid hydrocarbon as "the most important requirement" for a drag reducing polymer); *see* Ex. 1001, 1:39–41 (describing the prior art by stating "[i]n general, drag reduction depends in part upon the molecular weight of the polymer additive and its ability to dissolve in the hydrocarbon under turbulent flow"). And Petitioner and Dr. Epps identify drag reducing polymers within Eaton's disclosure (polystyrene and poly(ethylene/styrene)) that have solubility parameters falling within the solubility parameter range of Bow River crude oil (i.e., a range of 17.1–19.6 $MPa^{1/2}$). Pet. 42–43; Ex. 1005 ¶¶ 83–92. In our view, Petitioner applies known solubility

relationships to Eaton's disclosed drag reducing polymers to arrive at a polymer within the target solubility range—that is, a polymer that a skilled artisan would have expected to reduce drag in the claimed heavy, asphaltenic crude oil flowing through a pipeline.

Dr. Dunn's experiments do not persuade us otherwise. For example, although Dr. Dunn's gravimetric analysis was designed to measure the weight loss of polystyrene due to its dissolution in Bow River crude oil, each of the samples gained weight (from about 500 ppmw to up to about 22,000 ppmw) during the course of the experiment. Ex. 2021, Attachment C; Ex. 1056 ¶ 44–45. Dr. Dunn referred to the weight gain as "experimental uncertainty." Ex. 1043, 59:10–60:12. In the method of the challenged claims, only a small amount polymer is added to the hydrocarbon—from 0.1 ppmw to 500 ppmw—and would dissolve in the hydrocarbon. Thus, as Dr. Epps points out, the experimental uncertainty or error associated with Dr. Dunn's experiments could have masked the polystyrene's dissolution in the Bow River crude oil. Ex. 1056 ¶ 46.

Dr. Dunn also conducted gel permeation chromatography (GPC) experiments to determine whether polystyrene samples dissolve in Bow River crude oil. Ex. 2021, Attachment C. Dr. Dunn did not report the limit of detection associated with his GPC experiments. *See id.* Thus, as Dr. Epps testifies, Dr. Dunn "did not establish" the GPC test "as being sufficiently sensitive to allow one to validly conclude that polystyrene does not dissolve in Bow River crude oil at any amount within the range of 0.1 to 500 ppmw, as recited in the '118 patent." Ex. 1056 ¶ 48. Accordingly, we agree with Petitioner and Dr. Epps that Dr. Dunn's experiments fail to

support a finding that polystyrene does not dissolve in Bow River crude oil. Reply 14 n.3; Ex. 1056 ¶¶ 40–53.

In sum, Petitioner shows, by a preponderance of the evidence, that one of ordinary skill in the art would have a reason to combine the teachings of Eaton and Strausz and, in making that combination, a person of ordinary skill would have had a reasonable expectation of success at achieving a drag reducing polymer meeting the limitations of claims 1–7 and 11. That does not end our inquiry, however, because Patent Owner presents arguments and evidence regarding objective indicia of nonobviousness that we must consider before reaching our conclusion on obviousness. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016). We consider those arguments and evidence below.

4. Objective indicia of nonobviousness

Patent Owner argues that objective evidence supports the nonobviousness of the challenged claims. Resp. 26–51.[16] In a nutshell, Patent Owner argues that the evidence of record demonstrates overwhelmingly that Petitioner and others, "had a long-felt need, actively tried and failed to find a DRA [drag reducing additive] solution, [were] stunned by the surprising and unexpected results achieved by the 118 Patent, praised it, and then blatantly copied it." *Id.* at 26; *see id.* at 28–31 (long-felt need), 31–32 (failure of others), 32–33 (skepticism and unexpected results), 33–35 (praise), 35–36 (commercial success), 36–51 (copying), 51 (acquiescence).

[16] In this section, we cite to the confidential versions of Patent Owner's Response and Dr. Dunn's declaration, and the arguments and testimony contained therein. We also cite to Exhibit 2091, which Patent Owner filed under seal.

Notwithstanding what the teachings of the prior art would have suggested to one of ordinary skill in the art at the time of the invention, the totality of the evidence submitted, including objective evidence of nonobviousness, may lead to a conclusion that the claimed invention would not have been obvious to one of ordinary skill. *In re Piasecki*, 745 F.2d 1468, 1471–1472 (Fed. Cir. 1984). "For objective evidence of secondary considerations to be accorded substantial weight," however, "its proponent must establish a nexus between the evidence and the merits of the *claimed invention.*" *In re Huai-Hung Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) (quoting *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010)). "[N]exus" is a legally and factually sufficient connection between the objective evidence and the claimed invention, such that the objective evidence should be considered in determining nonobviousness. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988).

We apply "a presumption of nexus for objective considerations when the patentee shows that the asserted objective evidence is tied to a specific product and that product 'is the invention disclosed and claimed in the patent.'" *WBIP*, 829 F.3d at 1329 (citations omitted). Patent Owner bears the burden of showing that the product "is the invention disclosed and claimed in the patent." *See Demaco*, 851 F.2d at 1392 (discussing Patent Owner's burden in the context of commercial success).

Patent Owner's argument regarding nexus as to any of its identified secondary considerations is that it is entitled to a presumption of nexus because its evidence is tied to specific products that embody the claims of the '118 patent. Resp. 27; Tr. (confidential), 15:5 ("And on nexus, we have

a presumption of nexus here."). In that regard, Patent Owner contends that its Extreme Power, EP-1000, and EP-2000 products contain [redacted] Patent Owner also contends that Petitioner's and third party Flowchem's commercial products embody the claims of the '118 patent. For example, Patent Owner points to Petitioner's [redacted] product as "a virtual carbon copy of the [redacted]." *Id.* at 39 (citing Ex. 1001, 13:11–23; Ex. 2021 ¶ 180; Ex. 2091, BH-IPR0019). Likewise, Patent Owner states that Flowchem's commercial heavy crude oil DRA [redacted]

We do not find that Patent Owner is entitled to a presumption of nexus. As noted above, a presumption of nexus requires that the product "'is the invention disclosed and claimed in the patent.'" *WBIP*, 829 F.3d at 1329 (citations omitted). That is, a nexus is presumed when the commercial product "both 'embodies the claimed features' and is 'coextensive' with the claims at issue." *Sight Sound Techs., LLC v. Apple Inc.*, 809 F.3d 1307, 1319 (Fed. Cir. 2015).

Here, the Extreme Power products, as well as Petitioner's and Flowchem's products, are not coextensive with the challenged claims. All the products Patent Owner identifies are polymers. None of the challenged

claims of the '118 patent, however, are directed to polymer compositions.[17] Rather, the challenged claims recite methods of introducing a specific concentration of polymer into a hydrocarbon flowing in a pipeline. *See, e.g.*, Ex. 1001, 19:32–47. Thus, neither Patent Owner nor Petitioner produces a commercial product that is coextensive with the methods recited in the challenged claims. As a result, we determine that Patent Owner is not entitled to a presumption of nexus for any of its proffered secondary considerations. Because Patent Owner does not direct us to additional evidence to establish nexus, Patent Owner does not establish on this record a nexus between its proffered secondary considerations evidence and the claimed inventions.

5. Conclusion as to obviousness

Having considered the parties' arguments and evidence, we evaluate all of the evidence together to make a final determination of obviousness. *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1075 (Fed. Cir. 2012) (stating that a fact finder must consider all evidence relating to obviousness before finding patent claims

[17] Patent Owner appears to treat the claims as though they are directed to specific polymers, when they are not. For example, Patent Owner contends that Petitioner created its [redacted] product "with the [redacted] Resp. 43; *see id.* at 45 (arguing that Flowchem "used the 118 Patent as a blueprint" to move "to a substantially different DRA product, [redacted] But claims 1–7 and 11 encompass any drag reducing polymer having a solubility parameter within a certain number of $MPa^{1/2}$ of the solubility parameter of the hydrocarbon, and claims 8–10 (challenged in Ground 3 discussed *infra*) encompass any drag reducing polymer comprising certain heteroatoms and having a solubility parameter within a certain number of $MPa^{1/2}$ of the solubility parameter of the hydrocarbon.

invalid). In so doing, we conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 1–7 and 11 of the '118 patent would have been obvious over the combination of Eaton and Strausz.

F. Ground 3: Obviousness of Claims 8–10 over Eaton, Strausz, and Naiman

Petitioner argues that the combination of Eaton, Strausz, and Naiman would have rendered the subject matter of claims 8–10 obvious to a person of ordinary skill in the art. Pet. 47–60. Patent Owner disagrees. Resp. 26–56. Based on our review of the arguments and evidence of record, we determine that Petitioner demonstrates, by a preponderance of the evidence, that the subject matter of claims 8–10 would have been obvious over the combination of Eaton, Strausz, and Naiman as explained below.

1. The prior art discloses or suggests each and every limitation of claims 8–10

Petitioner asserts that a person of ordinary skill in the art would have been led by the above-referenced disclosures of Eaton, Strausz, and Naiman to a method comprising all of the elements recited in claims 8–10. Pet. 47–60 (citing Ex. 1005 ¶¶ 83, 84, 107–118, 120–24).[18] Claims 8 and 9 depend, either directly or indirectly, from claim 1. Claim 8 narrows the method of claim 1 to one in which a plurality of the drag reducing polymer's repeat units comprise a heteroatom, and claim 9 further limits the heteroatom to one "selected from the group consisting of an oxygen atom, a nitrogen atom,

[18] Petitioner addresses the limitations of claim 1 again. Pet. 52–54. Because we already address claim 1 in Ground 1 (anticipation based on Eaton) and Ground 2 (obviousness based on Eaton and Strausz), it is not necessary to discuss Petitioner's arguments in connection with claims 8–10.

a sulfur atom and/or a phosphorus atom." Ex. 1001, 20:8–12. Claim 10 is independent and recites a method similar to the method of claim 1, but includes additional limitations. For example, claim 10 incorporates the limitations for the drag reducing polymer solubility parameter, repeat units, and molecular weight set forth in claims 2–4, as well as the heteroatom limitations of claims 8 and 9. *Id.* at 20:13–36.

Petitioner explains how the combination of Eaton, Naiman, and Strausz discloses each of the limitations of claims 8–10. Regarding the limitations of claims 8–10 requiring a plurality of repeat units comprising a heteroatom and narrowing the heteroatom to one selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom and/or a phosphorus atom, Petitioner points to Naiman's polymers, which are made up of (1) styrene and alkyl acrylate units or (2) styrene, alkyl acrylate, and carboxylic acid units that are then reacted with polyamine, noting that each of the alkyl-acrylate units includes an oxygen heteroatom. Pet. 47 (citing Ex. 1004, Abstract, 4:50–5:8), 54–55 (addressing claims 8 and 9), 57 (addressing claim 10).

With respect to the limitations claim 10 that recite "the viscosity of the treated liquid hydrocarbon is not less than the viscosity of the liquid hydrocarbon prior to treatment with the drag reducing polymer" and that "the drag reducing polymer is added to the liquid hydrocarbon in the range from about 0.1 to about 500 ppmw," Petitioner and Dr. Epps explain how Naiman and Eaton disclose those limitations. *Id.* at 56, 58; 1005 ¶¶ 83, 120, 122–125; *see* Ex. 1002, 2:35–40 (Eaton disclosing a polymer concentration of from about 1 to 250 ppmw), 11:43–67 (Eaton disclosing a high viscosity polyalphaolefin polymer block); Ex. 1004, 4:12–16 (Naiman disclosing a

polymer concentration of from about 3 to about 35 ppmw), 5:21–25. Further, as to the limitations of claim 10 that require the drag reducing polymer to comprise "at least about 25,000 repeating units" and have "a weight average molecular weight of $1x10^6$ g/mol," Petitioner directs us to Naiman's disclosure that its drag reducing polymers should have a 3 million g/mol to a 5 million g/mol molecular weight, and Dr. Epps's undisputed testimony that the ordinary artisan would have recognized that many of Naiman's disclosed polymers have greater than 25,000 repeating units. *Id.* at 56–58 (citing Ex. 1004, 2:45–51; Ex. 1005 ¶¶ 103–105, 116).

Patent Owner does not address the merits of Petitioner's assertions regarding any of the above-described limitations. *See generally* Resp. We have reviewed the unrebutted arguments and evidence Petitioner presents with respect to those limitations of claims 1 and 8–10. We are persuaded by Petitioner's arguments (set forth above with citations to supporting evidence), which we adopt as our own. *See* Pet. 47, 52–58; *Nuvasive*, 841 F.3d at 974.

Claim 10 also recites the API gravity limitation, "introducing a drag reducing polymer having a solubility parameter of at least about 17 $MPa^{1/2}$, into a pipeline, such that the friction loss associated with the turbulent flow through the pipeline is reduced by suppressing the growth of turbulent eddies," and the solubility parameter limitation. Ex. 1001, 20:13–36. For those limitations, Petitioner directs us to Eaton's disclosure and the arguments it presents for Ground 1 (anticipation based on Eaton) and Ground 2 (obviousness based on Eaton and Strausz). Pet. 55–56. Regarding

the solubility parameter limitation[19] and drag reduction in particular, Petitioner's arguments are substantively the same as for Ground 2, except that Petitioner applies Strausz's teachings regarding solubility relationships to Naiman's polymers instead of Eaton's polymers. For example, Petitioner argues that a person of ordinary skill in the art following the combined teachings of Strausz and Naiman would have prepared a drag reducing polymer that was soluble in Bow River crude oil and, therefore, effective at treating that crude oil (i.e., would have reduced drag). Pet. 49, 52. Petitioner also argues that the ordinary artisan would have understood that drag reducing polymers with solubility parameters between 17.36 $MPa^{1/2}$ and 17.98 $MPa^{1/2}$, such as those prepared by following Naiman's disclosure, would have solubility parameters within 4 $MPa^{1/2}$ of the 17.1 $MPa^{1/2}$ to 19.6 $MPa^{1/2}$ solubility parameter of Bow River crude oil. *Id.* at 53 (citing Ex. 1005 ¶ 83).

Dr. Epps's testimony on those points also is substantively similar to his testimony for Ground 2. Specifically, Dr. Epps testifies that preparing such a drag reducing polymer from the teachings of Strausz and Naiman would have been routine, requiring the ordinarily skilled artisan to (a) identify from published solubility parameter information (or by performing a conventional group contribution calculation) which of

[19] Petitioner addresses both the requirement that the solubility parameter is within 4 $MPa^{1/2}$ of the solubility parameter of the liquid hydrocarbon, as recited in claims 1 and 10, and that the drag reducing polymer has a solubility parameter of at least 17 $MPa^{1/2}$, as recited in claim 10. Patent Owner's arguments do not differentiate between the two limitations. Accordingly, with respect to claim 10, we refer to the limitations collectively as the solubility parameter limitation.

Naiman's copolymers have a solubility parameter within the target 17.1–19.6 $MPa^{1/2}$ range and (b) perform the polymerization reaction that Naiman describes under conditions suitable to obtain the polymer, i.e., the ordinary artisan would have followed Naiman's emulsion polymerization process. Ex. 1005 ¶¶ 101 (explaining that Naiman's drag reducing polymers are comprised of "styrene, alkyl acrylates of from about four to about twelve carbon atoms . . . and, in some cases, a small amount of acrylic or methacrylic acid"), 109, 112–115; *see* Pet. 50–51.

And, similar to Ground 2, Dr. Epps provides example polymers that one of ordinary skill in the art would have prepared from Naiman's disclosure by applying the target solubility parameter based on Strausz's disclosed relationships. Ex. 1005 ¶¶ 113–114. Finally, Dr. Epps testifies that the ordinary artisan would have expected the prepared polymers to cause drag reduction in Bow River crude oil because the polymers would have been expected to have properties that would make them effective drag reducing agents in that oil; namely, a straight chain structure with minimal branching, high molecular weight, and solubility in the Bow River crude oil. *Id.* ¶ 121.

Patent Owner disagrees with Petitioner's assertions. First, Patent Owner argues that the combination of Eaton, Strausz, and Naiman fails to teach the API gravity limitation and introducing the drag reducing polymer into a pipeline as "for the same reasons discussed" with respect to Ground 1. Resp. 52. As discussed above, we find that Eaton either expressly or

inherently discloses those limitations. *See supra* § II.D.2.a–b. Accordingly, we are not persuaded by Patent Owner's arguments to the contrary.

Next, Patent Owner contends that Petitioner fails to meet its burden of showing that the combined teachings disclose the solubility parameter and drag reducing limitations for the same reasons as it articulates with respect to Ground 2. Indeed, Patent Owner argues both grounds together. Resp. 52–56. With regard to the combined teachings of Eaton, Strausz, and Naiman specifically, Patent Owner points to other properties that it asserts impact drag reduction, such as affinity, shear resistance, and rapid solubility in the fluid. *Id.* at 55.

Given that the parties' arguments for this ground mirror their arguments for Ground 2, we are persuaded by Petitioner's arguments for the same reasons we provide in connection with Ground 2. *See* § II.E.2. For example, regarding the solubility parameter limitation, we credit Dr. Epps's testimony setting forth how one of ordinary skill in the art, knowing the target solubility parameter of the hydrocarbon (i.e., 17.1–19.6 $MPa^{1/2}$ for Bow River crude oil), would have consulted the literature or used calculations to determine which of Naiman's disclosed polymers (e.g., styrene, poly(hexyl acrylate), poly(octyl acrylate), poly(dodecyl acrylate)) would provide a solubility parameter within the target range, and then used Naiman's disclosed polymerization process to prepare that polymer or polymers. Ex. 1005 ¶¶ 101, 109, 112–115.

Likewise, as in Ground 2, we are not persuaded by Patent Owner's arguments regarding drag reduction, because they are predicated on the premise that Petitioner relies on solubility parameters alone to argue that the combined teachings of Eaton and Strausz disclose drag reduction. Again,

Petitioner's arguments are not based on solubility alone, but also on Naiman's teaching that polymers made using its processes are drag reducing polymers, i.e., they would reduce drag and possess the additional properties associated with drag reduction, such as straight chain structure, high molecular weight, and shear resistance. Reply 14–15; Ex. 1056 ¶¶ 54–57. For the same reasons set forth in Section II.E.2, we find that Petitioner establishes, by a preponderance of the evidence that the combined teachings of Eaton, Strausz, and Naiman disclose or suggest that Naiman's polymers would have reduced drag in a liquid hydrocarbon having the recited asphaltene content and API gravity, such as Bow River crude oil.

Accordingly, based on the full trial record, Petitioner establishes, by a preponderance of the evidence, that the collective teachings of Eaton, Strausz, and Naiman disclose each limitation of claims 8–10.

2. Rationale for combining the teachings of Eaton, Strausz, and Naiman and reasonable expectation of success

Similar to its argument for Ground 2, Petitioner asserts that a person of ordinary skill would have recognized that a drag reducing polymer should have a solubility parameter between 17.1 $MPa^{1/2}$ and 19.6 $MPa^{1/2}$ "to be most effective as a drag reducing polymer." Pet. 48 (citing Ex. 1005 ¶ 107), 58–59 (citing Ex. 1005 ¶ 110). Petitioner further asserts that, although the skilled artisan would have understood that an effective drag reducing polymer could be prepared according to Eaton's disclosure, such a person would have known that Eaton's drag reducing polymers are prepared using a Ziegler-Natta polymerization process, which limits the type of useful monomers and requires an expensive catalyst system. *Id.* (citing Ex. 1005 ¶ 108). Thus, Petitioner asserts that an ordinarily skilled artisan would have been prompted to look for other drag reducing polymers that would be

effective in heavy, asphaltenic crude oil, but made using a more commercially desirable process. *Id.* at 48–49 (citing Ex. 1005 ¶¶ 109, 113–114). In so doing, Petitioner asserts that a skilled artisan would have been prompted to substitute Naiman's drag reducing polymers, which are prepared using an emulsion polymerization process, for those disclosed in Eaton. *Id.* at 49–50, 59–60. According to Petitioner, ordinary artisans would have understood that Naiman's process was less expensive to perform and less limited in the types of monomers that could be utilized to prepare the polymers, i.e. more commercially desirable. *Id.* at 49. In sum, Petitioner argues that the skilled artisan would have considered Naiman's polymers "to be an advantageous replacement" for Eaton's polymers for use in treating Bow River heavy crude oil. *Id.* at 50.

Petitioner further contends that one of ordinary skill in the art following the combined teachings of Eaton, Strausz, and Naiman would have had a reasonable expectation of success in preparing drag reducing polymers meeting all of the limitations of claims 8–10 and would have expected such polymers to reduce drag in a liquid hydrocarbon meeting the recited asphaltene content and API gravity, such as Bow River crude oil. *Id.* at 59–60 (citing Ex. 1005 ¶¶ 117–118, 121).

Patent Owner does not agree. First, Patent Owner reiterates its criticisms of Dr. Epps's testimony regarding target solubility parameters and reasonable expectation of success based on the solubility parameter relationships Strausz describes. Resp. 62–63 (referring back to Resp. § III.D, regarding Eaton's disclosure of the solubility parameter limitation, and § IV.C.2, Patent Owner's arguments that Petitioner does not provide a sufficient rationale for combining the teachings of Eaton and Strausz).

Patent Owner also reiterates its arguments from Ground 2 that one cannot predict whether a polymer will reduce drag based on solubility alone. *Id.* at 63–64. We are not persuaded by those arguments for the same reasons we provide in Section II.E.3.

Patent Owner further asserts that Eaton teaches away from using Naiman's polymers because an ordinarily skilled artisan would have found that Naiman's polymers poison the "Ziegler-Natta catalyst that [Eaton discloses is] 'critical' to obtaining results in Eaton." Resp. 64–65. In other words, Patent Owner contends that substituting Naiman's polymers for Eaton's polymers would render Eaton inoperable for its intended purpose. *Id.* at 65.

We are not persuaded by Patent Owner's argument, as it does not address Petitioner's proposed combination. Petitioner's combination is not based upon using Eaton's Ziegler-Natta catalyst or polymerization process with Naiman's monomers to prepare a drag reducing polymer. As explained above, Petitioner's combination replaces Eaton's drag reducing polymers and method of making those polymers (i.e., Ziegler-Natta polymerization) with Naiman's more commercially viable drag reducing monomers and polymerization method. Thus, Patent Owner's argument that Naiman's polymers would poison Eaton's Ziegler-Natta catalyst is misplaced.

Further, the fact that Eaton and Naiman disclose drag reducing polymers made from different types of monomers and processes does not mean that they teach away from one another, or that using Naiman's polymers and polymerization process in Eaton's Bow River crude oil would change Eaton's principle of operation, i.e., using drag reducing polymers to

reduce the frictional pressure drops in the flow of crude oil through pipelines.

A reference does not teach away if it merely expresses a general preference for an alternative invention from amongst the options available to the ordinarily skilled artisan, and the reference does not discredit or discourage investigation into the invention claimed. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Patent Owner does not point to any statements in Eaton discouraging or discrediting the use of polymers containing heteroatoms, or polymers made by processes that other than the Zeigler-Natta process. In other words, the fact that Eaton and Naiman disclose different solutions to a similar problem (i.e., different polymers to reduce frictional pressure drops in the flow of crude oil through pipelines) does not teach away from their combination. *See id.* Nor does it render Eaton inoperable for its intended purpose. Indeed, there is sufficient evidence in the record before us that one of ordinary skill in the art would have appreciated that introducing one of Naiman's polymers (made by Naiman's process) into a liquid hydrocarbon flowing through a pipeline, such as the Bow River crude oil that Eaton discloses, would result in an operable method. Pet. 48–50; Ex. 1005 ¶¶ 109, 118, 121. That is, the polymer would have been expected to reduce frictional pressure drops in the flow of crude oil through pipelines (i.e., reduce drag).

In sum, based on the full trial record, we do not agree that Eaton teaches away from using Naiman's polymers or that using Naiman's polymers renders Eaton inoperable for its intended purpose. Rather, we find that replacing Eaton's polymers with the polymers described in Naiman would have been a substitution of one known drag reducing polymer for

another with the predictable result of reducing the frictional loss associated with turbulent flow through a pipeline by suppressing the growth of turbulent eddies, i.e., reducing drag. *See KSR Int'l Co.*, 550 U.S. at 416.

3. Objective indicia of nonobviousness

Patent Owner argues that objective evidence supports the nonobviousness of claims 8–10, relying on the same arguments and evidence as presented for Ground 2. For the same reasons as stated in Section II.E.4, *supra*, we find that Patent Owner does not establish on this record a nexus between its proffered secondary considerations evidence and the claimed inventions.

4. Conclusion as to obviousness

Having considered the parties' arguments and evidence, we evaluate all of the evidence together to make a final determination of obviousness. *Cyclobenzaprine*, 676 F.3d at 1075. In so doing, we conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 8–10 of the '118 patent would have been obvious over the combination of Eaton, Strausz, and Naiman.

III. MOTION TO EXCLUDE

We turn next to Patent Owner's Motion to Exclude. *See* Papers 65, 72, 75. Patent Owner moves to exclude Exhibits 1047–1049 and paragraphs 2–7 of Dr. Epps's reply declaration (Ex. 1046 (confidential version) Ex. 1056 (public version)). Paper 65, 1. We first address Exhibits 1047–1049, and then turn to Dr. Epps's reply declaration.

A. Exhibits 1047–1049

Exhibits 1047–1049 are documents setting forth additional information regarding the API gravity of Bow River crude oil. Patent

Owner argues that we should exclude Exhibits 1047–1049 as irrelevant because they are "newly cited prior art that raise new theories of invalidity and are thus irrelevant to the theories in the Petition" and the instituted grounds. *Id.* According to Patent Owner, the "new theories of invalidity" relate to whether the Bow River crude oil disclosed in Eaton inherently has "an API gravity of less than about 26°." *Id.* at 2–3. Patent Owner further argues that permitting such a new theory of invalidity based upon new prior art references would be unfairly prejudicial because Patent Owner does not have an opportunity to respond to those arguments. *Id*. at 1, 4–5.

Petitioner responds that Exhibits 1047–1049 are "highly relevant" to the instituted grounds and do not raise new theories of unpatentability. Paper 72, 1–3. Petitioner asserts that it has "always contended that the API gravity of Bow River crude oil is less than about 26°," and that it presented additional evidence regarding the API gravity value to rebut Patent Owner's argument and evidence in the Response that the API gravity of Bow River crude oil differs from the value presented in Table 1 of the '118 patent. *Id.* at 2. Petitioner further asserts that it could not have predicted in advance that Patent Owner would present such arguments and evidence regarding the API gravity of Bow River crude oil reported in the '118 patent. *Id.* Petitioner also argues Patent Owner's assertion that Patent Owner is prejudiced by the lack of an opportunity to respond to Petitioner's argument is moot because the Board authorized, and Patent Owner filed, a sur-reply. *Id.* at 3–4. Finally, Petitioner argues that Patent Owner's arguments on pages 2–3 of the motion to exclude contain substantive argument regarding whether the API gravity of Bow River crude oil is necessarily less than about 26°. *Id.* at 7. In other words, Petitioner argues that Patent Owner's

arguments are not directed to admissibility, but rather, are akin to an unauthorized sur-reply.

We do not affirmatively rely on any of Exhibits 1047–1049 in our present determination. Accordingly, we need not decide Patent Owner's Motion to Exclude those exhibits, and we dismiss the motion as moot.[20]

B. Paragraphs 2–7 of Dr. Epps's Reply Declaration

Paragraphs 2–7 of Dr. Epps's reply declaration contain testimony regarding how a person of ordinary skill in the art would interpret "about 26°" in the phrase "an API gravity of less than about 26°." Patent Owner moves to exclude those paragraphs, arguing that Petitioner's claim construction argument and Dr. Epps's testimony "should have been disclosed in the Petition." Paper 65, 6. Patent Owner further argues that paragraphs 2–7 constitute *ipse dixit* testimony that is irrelevant and contradicts Dr. Epps's deposition testimony. *Id.* at 6–8.

Petitioner contends that Dr. Epps's testimony is proper because it responds to the claim construction of "about 26°" that Patent Owner proposes in the Patent Owner Response and addresses our observation in the

[20] Although we dismiss Patent Owner's Motion to Exclude as moot, we note that much of Patent Owner's argument in support of the motion advances additional arguments unrelated to the admissibility of Exhibits 1047–1049. For example, Patent Owner's Motion to Exclude and Reply in support of the motion both advance its theory as to why Eaton does not inherently disclose the API gravity limitation. *See, e.g.*, Paper 65, 3 ("As explained extensively in [the] Patent Owner Response, simply because 'Bow River Crude' is identified does not mean that any particular API gravity is 'necessarily present'—a requirement for inherency. Paper 47 at 11-14."); Paper 75, 3 ("[I]t is well known that the API gravity of particular crude samples can vary depending on what field it was taken from, when it was taken, what pipeline it was taken from, and whether it was diluted. Paper 47 at 10-15."). Such argument in a motion to exclude is improper.

Institution Decision that Patent Owner's arguments about the API gravity of Bow River crude oil implicate claim construction of the phrase "less than about 26°." Paper 72, 4–5. Petitioner further argues that Patent Owner's arguments that Dr. Epps's testimony is *ipse dixit* and contrary to his deposition testimony go to the weight of the evidence, not its admissibility. *Id.* at 5–6.

We do not affirmatively rely on Dr. Epps's reply declaration testimony in construing the term "an API gravity of less than about 26°." Thus, we dismiss as moot Patent Owner's request to exclude that testimony. Even if Patent Owner's request were not moot, however, we would agree with Petitioner that Dr. Epps's testimony was proper reply testimony, and that Patent Owner's arguments go to the weight rather than the admissibility of that testimony.

In sum, we dismiss Patent Owner's Motion to Exclude as moot with respect to Exhibits 1047–1049 and paragraphs 2–7 of Dr. Epps's reply declaration (Ex. 1046 (confidential); Ex. 1056 (public)).

IV. MOTIONS TO SEAL

Patent Owner and Petitioner each filed unopposed Motions to Seal portions of certain papers and exhibits. Paper 46; Paper 58; Paper 69. The Board previously entered a protective order to govern the confidential information produced and filed in this proceeding. Paper 40, 8 (granting Patent Owner's motion for entry of a protective order and placing Patent Owner's modified protective order (Paper 20, Addendum A) into effect, subject to the modifications and clarifications set forth in our Order granting the motion).

In its first Motion to Seal, Patent Owner seeks to seal portions of the Patent Owner Response and "certain exhibits to the Patent Owner Response that contain confidential information" belonging to Patent Owner, Petitioner, and/or Flowchem, including portions of Dr. Dunn's declaration (Ex. 2021). Paper 46, 1. Other than Dr. Dunn's declaration, Patent Owner does not identify any of the exhibits it seeks to seal. In its second Motion to Seal, Patent Owner seeks to seal portions of its Sur-Reply. Paper 69, 1. Patent Owner filed redacted public versions of the Patent Owner Response, Dr. Dunn's declaration, and the Sur-Reply. Paper 48 (Response); Paper 71 (Sur-Reply); Ex. 2021 (Dr. Dunn's redacted declaration). Patent Owner did not file redacted versions of the other exhibits, but seeks to seal them in their entirety.

In its Motion to Seal, Petitioner seeks to seal portions of its Reply, portions of Dr. Epps's reply declaration, Exhibit 1042 and Exhibit 1045. Paper 58, 1–2. Petitioner filed redacted public versions of its Reply (Paper 59) and Dr. Epps's reply declaration (Ex. 1056), but did not file redacted versions of Exhibits 1042 and 1045. Petitioner seeks to seal Exhibits 1042 and 1045 in their entirety.

"There is a strong public policy for making all information filed in a quasi-judicial administrative proceeding open to the public, especially in an *inter partes* review which determines the patentability of claims in an issued patent and therefore affects the rights of the public." *Garmin Int'l v. Cuozzo Speed Techs., LLC*, IPR2012–00001, slip op. at 1–2 (PTAB Mar. 14, 2013) (Paper 34). For this reason, except as otherwise ordered, the record of an *inter partes* review trial shall be made available to the public. *See* 35 U.S.C. § 316(a)(1); 37 C.F.R. § 42.14. The standard for granting a motion to seal is

good cause. 37 C.F.R. § 42.54. That standard includes showing that the information addressed in the motion to seal is truly confidential, and that such confidentiality outweighs the strong public interest in having the record open to the public. *See Garmin*, slip op. at 2–3.

After having considered the submissions, we deny the Motions without prejudice. We are not persuaded that the parties establish good cause to seal all of the information identified in their respective motions. For example, both Petitioner and Patent Owner merely assert that certain information should be sealed because it was designated "Highly Confidential Information" or "CONFIDENTIAL" under the protective order entered in the copending litigation. *See, e.g.*, Paper 46, 1; Paper 58, 1; Paper 69, 2. And, as noted above, except for Dr. Dunn's declaration, Petitioner does not even identify the exhibits it seeks to seal.

We deny the motions without prejudice, and order the parties to work together to jointly file a motion to seal, setting forth: (1) each paper or exhibit that the parties seek to seal, in part or in full; and (2) a showing why the information in each paper or exhibit (or the portions thereof) that the parties seek to seal is truly confidential. To the extent that the parties have not yet filed redacted versions of each paper and exhibit they seek to seal, the parties shall file such redacted versions.

We further note that this decision will be entered as a non-public version covering protective order material because it references and cites several documents subject to the parties' Motions to Seal. The parties may, as part of the joint motion to seal, request that the Board seal portions of this decision and/or the non-public version of the oral hearing transcript (Paper 77). The parties shall provide a joint proposed redacted version of this

decision and/or the oral hearing transcript exhibits to the joint motion to seal. We caution the parties that there is a strong public interest in an unsealed Final Written Decision, and any justification to seal the decision must meet the good cause standard. Furthermore, any proposed redactions to the decision and the oral hearing transcript should be narrowly tailored.

The parties are authorized to file the joint motion to seal within ten (10) business days of the date of this decision. The parties shall meet and confer in good faith as necessary to comply with our orders in this decision. 37 C.F.R. § 42.11.

V. CONCLUSION

For the foregoing reasons, we determine that Petitioner establishes, by a preponderance of the evidence, that claims 1, 3, 4, 6, 7, and 11 of the '118 patent are unpatentable under 35 U.S.C. § 102 as anticipated by Eaton, claims 1–7 and 11 of the '118 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Eaton and Strausz, and claims 8–10 of the '118 patent are unpatentable under 35 U.S.C. § 103 over the combination of Eaton, Strausz, and Naiman.

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 1–11 of the '118 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude (Paper 65) is *dismissed* as moot;

FURTHER ORDERED that Patent Owner's and Petitioner's Motions to Seal (Paper 46; Paper 58; Paper 69) are *denied* without prejudice;

FURTHER ORDERED that within ten (10) business days of this decision, the parties shall file a joint motion to seal in accordance with the instructions set forth above; and

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

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