

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARKEMA FRANCE,
Petitioner,

v.

HONEYWELL INTERNATIONAL, INC.,
Patent Owner.

Case IPR2015-00915
Patent 8,710,282 B2

Before JO-ANNE M. KOKOSKI, JON B. TORNQUIST, and
ROBERT A. POLLOCK, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Arkema France (“Petitioner”) filed a Petition (“Pet.”) to institute an *inter partes* review of claims 1–46 of U.S. Patent No. 8,710,282 B2 (“the ’282 patent,” Ex. 1001). Paper 1. On October 21, 2015, we instituted an *inter partes* review of claims 1–46 on two grounds of unpatentability (Paper 14, “Dec. on Inst.”). Honeywell International, Inc. (“Patent Owner”) filed a Patent Owner Response (Paper 19, “PO Resp.”). Petitioner filed a Reply (Paper 39, “Reply”).

Petitioner filed a Motion to Exclude (Paper 44) Exhibits 2007, 2009, 2014, 2017, 2020, 2023, 2025, 2027, and 2028. Patent Owner filed an Opposition (Paper 48), and Petitioner filed a Reply (Paper 49). We decide Petitioner’s Motion to Exclude in a separate decision, issued concurrently with this Final Written Decision.

An oral hearing was held on July 18, 2016. A transcript of the hearing is included in the record (Paper 55, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that claims 1–46 of the ’282 patent are unpatentable.

A. *The ’282 Patent*

The ’282 patent, titled “Integrated Process for the Manufacture of Fluorinated Olefins,” is directed to methods of dehydrohalogenating a fluorinated alkane in the presence of a dehydrohalogenation agent (“DHA”) to produce a fluorinated olefin. Ex. 1001, 2:52–56. According to the ’282 patent, the claimed methods increase cost efficiency of the

dehydrohalogenation production of fluorinated olefins by recovering and recycling the spent DHA. *Id.* at 2:49–52.

The methods described in the '282 patent include: (1) hydrogenating a first haloolefin to produce a haloalkane; (2) optionally separating the haloalkane into intermediate product streams, consisting of a first stream rich in at least a first alkane, a second stream rich in a second alkane, and an alkane recycle stream; (3) dehydrohalogenating the haloalkane in step (1) or (2) in the presence of a DHA to produce a second haloolefin; (4) withdrawing a reaction stream comprising spent DHA; and (5) recovering, purifying, and/or regenerating spent DHA. *Id.* at 3:4–17. The Specification includes embodiments where the first haloalkene is hexafluoropropylene (HFP), the intermediate haloalkanes are 1,1,1,2,3,3-hexafluoropropane (HFC-236ea) and/or 1,1,1,2,3-pentafluoropropane (HFC-245eb), and the second haloolefin is 2,3,3,3-tetrafluoropropene (HFO-1234yf) and/or 1, 2, 3,3,3-pentafluoropropene (HFO-1225ye). *Id.* at 3:17–4:12.

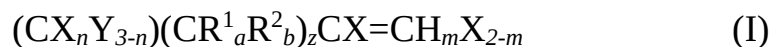
The Specification states that the dehydrohalogenation step “can be carried out in a liquid phase in the presence of a [DHA],” and describes an embodiment where “the converting step involves a reaction in which HFC-245eb and/or HFC-236ea is contacted with a [DHA] such as KOH, NaOH, Ca(OH)₂, LiOH, Mg(OH)₂, CaO, and combinations thereof to form the fluorinated olefin.” *Id.* at 12:12–22. The Specification also states that spent DHA and by-product salts “may be withdrawn from the reactor by a product stream either continuously or intermittently using one or more known separation techniques,” and, “[i]n certain embodiments, withdrawal of spent [DHA] is especially beneficial for component separation as it allows for facile separation of organic and [DHA].” *Id.* at 13:16–18, 13:22–26. For

example, the Specification describes “stopping the stirrer and then removing spent [DHA] during the time agitation is stopped” and taking that product stream that “typically carries with it some dissolved organic (e.g. HFC-236ea and/or HFC-245eb)” to “a container where additional separation of the [DHA] and organic can be accomplished using one or more” known separation techniques. *Id.* at 13:29–38.

Claims 1, 10, 21, and 36 are independent claims. Claims 1 and 21 are illustrative, and recite as follows:

1. A method for producing at least one fluorinated olefin comprising:

a. hydrogenating a starting material stream comprising at least one alkene according to Formula (I):



by contacting said starting material with a reducing agent to produce an intermediate product stream comprising at least one alkane according to Formula (II):



where:

each X is independently Cl, F, I or Br, provided that at least two Xs are F;

each Y is independently H, Cl, F, I or Br;

each R¹ is independently H, Cl, F, I, Br or unsubstituted or halogen substituted methyl or ethyl radical;

each R₂ [sic] is independently H, Cl, F, I, Br or unsubstituted or halogen substituted methyl or ethyl radical;

n is 1, 2 or 3;

a and b are each 0, 1 or 2, provided that a+b=2;

m is 0, 1 or 2; and

z is 0, 1, 2 or 3;

b. optionally, separating said intermediate product stream into a plurality of intermediate product streams, said plurality of intermediate product streams comprising two or more streams selected from the group consisting of a first stream rich in at least a first alkane according to Formula II, a seconds [sic]

stream rich in at least a second alkane according to Formula II, and an alkane recycle stream;

- c. dehydrofluorinating, in the presence of a dehydrohalogenating agent, at least a portion of said intermediate process stream from step (a) or said plurality of intermediate process streams of step (b) to produce an alkene product stream comprising 1,1,1,2,3-pentafluoropropene and at least one additional alkene having a lower degree of fluorine substitution compared to the degree of fluorination of the compound of formula (I); and
- d. withdrawing from a dehydrofluorinated product stream a product reaction stream comprising a spent dehydrohalogenating agent; and
- e. recovering spent dehydrohalogenating agent.

Ex. 1001, 16:29–17:4.

21. A process for the manufacture of a fluoroolefin comprising:

- (a) dehydrohalogenating a haloalkane in the presence of KOH to produce a haloalkene;
- (b) withdrawing a reaction stream comprising spent KOH; and
- (c) recovering spent KOH.

Id. at 18:1–7.

B. Prior Art

The pending grounds of unpatentability in this *inter partes* review are based on the following prior art:

Reference	Description	Date	Exhibit No.
Smith	WO 2009/138764 A1	May 15, 2009	1003
Sedat ¹	French Patent App. Pub. No. 2 940 968	July 16, 2010	1004 1005 (English translation)

C. Pending Grounds of Unpatentability

This *inter partes* review involves the following grounds of unpatentability:

Reference(s)	Basis	Challenged Claims
Sedat	§ 103(a)	21–27, 30–38, 41–46
Smith and Sedat	§ 103(a)	1–20, 21, 28, 29, 36, 39, 40

Dec. on Inst. 18.

II. ANALYSIS

A. Claim Interpretation

We interpret claims of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent in which [the claims] appear[.]” 37 C.F.R. § 42.100(b); *see also Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (“We conclude that [37 C.F.R. § 42.100(b)] represents a reasonable exercise of the rulemaking authority that Congress delegated to the Patent Office.”). The Board, however, may not “construe claims during IPR so broadly that its

¹ We refer to “Sedat” as the English translation of the original reference. Petitioner provided an affidavit attesting to the accuracy of the translation. Ex. 1005, 18–19; *see* 37 C.F.R. § 42.63(b).

constructions are *unreasonable* under general claim construction principles. . . . “[T]he protocol of giving claims their broadest reasonable interpretation . . . does not include giving claims a legally incorrect interpretation.”

Microsoft Corp. v. Proxyconn, Inc., 789 F.3d 1292, 1298 (Fed. Cir. 2015) (citation omitted). “Rather, ‘claims should always be read in light of the specification and teachings in the underlying patent’” and “[e]ven under the broadest reasonable interpretation, the Board’s construction ‘cannot be divorced from the specification and the record evidence.’” *Id.* (citations omitted). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. “*recovering spent DHA*” and “*recovering spent KOH*”

For purposes of the Decision on Institution, we addressed the interpretation of the claim terms “recovering spent DHA” as set forth in claims 1 and 10, and “recovering spent KOH” as set forth in claims 21 and 36, and determined that the terms did not need to be construed expressly. Dec. on Inst. 7–10. Based on our review of the complete record and the claim construction arguments raised by the parties, for purposes of this Final Written Decision we determine that it is necessary to expressly construe these claim terms.

Petitioner proposes that we construe “recovering spent DHA” and “recovering spent KOH” to mean “collecting spent DHA or KOH, respectively, for further use (may include separating, purifying, concentrating and/or regenerating).” Pet. 14. In support of its construction, Petitioner contends that the Specification “describes ‘the invention’ as relating ‘. . . to a method of increasing the cost efficiency for

dehydrohalogenation production of a fluorinated olefin by recovering and recycling spent reagent’ as well as ‘(d) recovering, purifying and/or regenerating spent [DHA].’” *Id.* (citing Ex. 1001, 2:49–52, 3:15–17).

Patent Owner proposes that we construe the terms to mean “substantially separating spent [DHA or KOH] from any other materials in the [product reaction stream (Claim 1)/second product reaction stream (Claim 10)/reaction stream (Claims 21 and 36)].” PO Resp. 9. Patent Owner argues that the ’282 patent discusses recovering spent DHA or KOH “in the context of separating organics, and any identified heavies, dissolved in the aqueous reaction mixture from the previously withdrawn spent DHA or KOH.” *Id.* at 7 (citing Ex. 1001, 2:61–63, 13:29–45, 15:44–49, 16:14–23). Patent Owner points to an example in the Specification that “describes ‘recovering’ in terms of a Scrubber Product Collection Cylinder (SPCC), where the SPCC is configured to trap the dissolved organics so as to separate the dissolved organics from the spent DHA or KOH.” *Id.* (citing Ex. 1001, 15:43–47). Patent Owner also notes that “additional positively recited steps of purifying, concentrating and/or regenerating found in the dependent claims demonstrate that such steps are distinct from the steps of recovering spent DHA and recovering spent KOH” and should not be read into the “recovering spent [DHA or KOH]” terms. *Id.* at 8.

Based on the record before us, we are persuaded that Patent Owner’s interpretation is the broadest reasonable interpretation in light of the Specification. Patent Owner’s proposed interpretation is consistent with the Specification, which describes separating the spent DHA or KOH from other components in the product stream/second product stream/reaction stream that is withdrawn from the reactor. *See, e.g.*, Ex. 1001, 2:62–64 (“Removal

of spent [DHA] from the reactor allows for facile separation of the organic and [DHA].”), 5:16–19 (“From the reaction product stream, a stream of spent [DHA] may be withdrawn and purified on a continuous or intermittent basis.”), 13:23–26 (“[W]ithdrawal of spent [DHA] is especially beneficial for component separation as it allows for facile separation of organic and [DHA].”), 13:34–38 (“Spent [DHA] and dissolved organic would be taken into a container where additional separation of [DHA] and organic can be accomplished using one or more of the foregoing separation techniques.”)

Accordingly, we interpret “recovering spent [DHA or KOH]” to mean “separating spent [DHA or KOH] from other materials in the [product reaction stream (Claim 1)/second product reaction stream (Claim 10)/reaction stream (Claims 21 and 36)].”

2. *“product reaction stream,” “second product reaction stream,” and “reaction stream”*

Petitioner proposes that we construe the claim terms “product reaction stream” as used in claim 1, “second product reaction stream” as used in claim 10, and “reaction stream” as used in claims 21 and 36 (collectively, “the stream terms”) to mean “a volume of material present after dehydrofluorination including spent DHA that may also contain by-product salts and/or dissolved organics.” Pet. 16. Patent Owner proposes that we construe the stream terms to mean “a continuous flow of a fluid consisting of at least spent [DHA or KOH] resulting from a dehydrofluorination reaction.” PO Resp. 11.

We are not persuaded that the stream terms are limited to a continuous flow of fluid as Patent Owner proposes. The Specification states that “[s]pent [DHA] and by-product salts (e.g. metal fluoride salts) may be withdrawn from the reactor by a product stream *either* continuously *or*

intermittently.” Ex. 1001, 13:16–18 (emphasis added). The Specification further states:

The product stream containing spent [DHA] typically carries with it some dissolved organic (e.g. HFC-236ea and/or HFC-245eb). By stopping the stirrer and then removing spent [DHA] during the time agitation is stopped, separation of [DHA] and such organic can be facilitated. Spent [DHA] and dissolved organic would be taken into a container where additional separation of [DHA] and organic can be accomplished using one or more of the foregoing separation techniques.

Id. at 13:29–38. The examples in the Specification also describe stopping the stirrer at predetermined time intervals, removing spent KOH, and re-starting the stirrer. *Id.* at 15:24–16:27. Taken together, these disclosures in the Specification indicate that the product reaction stream/second product reaction stream/reaction stream may be a continuous flow of fluid, or it may be withdrawn intermittently.

Accordingly, we interpret the stream terms to mean “a volume of material comprising spent [DHA or KOH] resulting from a dehydrofluorination reaction.”

B. Antedating Smith and Sedat

Smith was published, pursuant to Article 21(2) of the Patent Cooperation Treaty, on November 19, 2009, from an international application that designated the United States that was filed on May 15, 2009. Pet. 20–21; Ex. 1003. Thus, Smith is available as prior art under 35 U.S.C. § 102(e) as of May 15, 2009, and under 35 U.S.C. § 102(a) as of its November 19, 2009 publication date. Patent Owner acknowledges that “Smith is entitled to a prior art date of no earlier than May 15, 2009.” PO Resp. 38. Patent Owner also acknowledges that Sedat “is entitled to a prior art date of no earlier than July 16, 2010.” *Id.* at 45. The parties do not

dispute that the '282 patent is entitled to a priority date of October 12, 2010, the filing date of the provisional application that led to the issuance of the '282 patent. Pet. 4–7; PO Resp. 2, 37.² Instead, Patent Owner seeks to disqualify Smith and Sedat as prior art by establishing a date of invention prior to the publication of these references. PO Resp. 24. In particular, Patent Owner contends that the named inventors of the '282 patent “actually reduced to practice at least claims 21–31, 33, 36–42 and 44 on or before September 2008.” *Id.* at 27–37. With respect to claims 1–46, Patent Owner contends that the inventors conceived of the claimed invention as early as March 26, 2008, and that they were reasonably diligent in reducing the claimed subject matter to practice during the time period starting before the publication of the references and ending when the claims were constructively reduced to practice when the provisional patent application was filed on October 12, 2010. *Id.* at 26–27, 37–60. As a consequence, Patent Owner contends that neither Smith nor Sedat qualifies as prior art.

Petitioner bears the burden of persuasion that the challenged claims are unpatentable, which includes the burden of establishing that any reference upon which it relies constitutes prior art under 35 U.S.C. § 102. 35 U.S.C. § 316(e); *see Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1576 (Fed. Cir. 1996) (holding that the challenger “bore the burden of persuasion . . . on all issues relating to the status of [the asserted reference] as prior art”). However, because Petitioner offered Smith and Sedat into evidence, each of

² We note that, in a number of places in its Response, Patent Owner identifies the date of filing of the provisional application as October 21, 2010, instead of October 12, 2010. *See* PO Resp. 37, 38, 45, 59. We recognize this is a typographical error (*see* Ex. 1001 at [60]), and that there is no dispute as to the filing date of the provisional application.

which was published before the '282 patent's filing date, Patent Owner bears the burden of producing evidence supporting a date of invention before Smith and Sedat were published. *Mahurkar*, 79 F.3d at 1576–77; see *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378–80 (Fed. Cir. 2015). Thus, Patent Owner can antedate Smith and Sedat by establishing (i) an actual reduction to practice before the publication of Smith and Sedat, or (ii) conception before the references published followed by a diligent reduction to practice. *Purdue Pharma L.P. v. Boehringer Ingelheim GMBH*, 237 F.3d 1359, 1365 (Fed. Cir. 2001) (“To antedate . . . an invention, a party must show either an earlier reduction to practice, *or* an earlier conception followed by a diligent reduction to practice.”) (emphasis added) (citation omitted).

At the outset, as we note in our accompanying Decision on Petitioner's Motion to Exclude, we have determined that several exhibits provided by Patent Owner with respect to the antedating arguments are inadmissible for lack of proper authentication. We will not consider the excluded evidence as part of this Decision.

1. Actual Reduction to Practice

Patent Owner contends that the invention set forth in claims 21–31, 33, 36–42, and 44 was actually reduced to practice “on or before September 2008.” PO Resp. 27. In support of its contentions, Patent Owner proffers a declaration from listed inventor Hsueh Sung Tung (Ex. 2006, “the Tung Declaration”), and the Declarations of Angela Goodie (Ex. 2037, “the Goodie Declaration”) and Daniel C. Merkel (Ex. 2038, “the Merkel Declaration”) as corroborating witnesses. Patent Owner provides several supporting exhibits (Exs. 2010–2013, 2016), and cites to the Declaration of

Robert E. Lousenberg, Ph.D. (“Lousenberg Declaration,” Ex. 2002). *See id.* at 27–30. Patent Owner also presents a table that maps each of the elements of claims 21–31, 33, 36–42, and 44 to its proffered evidence. *Id.* at 30–37.

Reduction to practice is a question of law predicated on subsidiary factual findings. *Brown v. Barbacid*, 276 F.3d 1327, 1332 (Fed. Cir. 2002). A party seeking to establish an actual reduction to practice must satisfy a two-prong test: (1) the party must construct an embodiment or perform a process that satisfies every element of the claim at issue, and (2) the embodiment or process must operate for its intended purpose. *Cooper v. Goldfarb*, 154 F.3d 1321, 1327 (Fed. Cir. 1998). “The inventor must also have ‘contemporaneous recognition and appreciation of the invention’ represented by the claims.” *Purdue*, 237 F.3d at 1365–66 (quoting *Estee Lauder Inc. v. L’Oreal, S.A.*, 129 F.3d 588, 593 (Fed. Cir. 1997)). If an inventor is unable to establish conception until the invention is reduced to practice through a successful experiment, “simultaneous conception and reduction to practice occur.” *Id.* at 1366. The invention does not have to be at a commercially satisfactory stage of development for an actual reduction to practice, but must have been sufficiently tested to demonstrate that it will work for its intended purpose. *See, e.g., Scott v. Finney*, 34 F.3d 1058, 1061–62 (Fed. Cir. 1994) (citing numerous cases wherein the character of the testing necessary to support an actual reduction to practice varied with the complexity of the invention and the problem it solved); *see also Wells v. Fremont*, 177 USPQ 22, 24–25 (BPAI 1972) (“[E]ven where tests are conducted under ‘bench’ or laboratory conditions, those conditions must ‘fully duplicate each and every condition of actual use’ or if they do not, then the evidence must establish a relationship between the subject matter,

the test condition and the intended function setting of the invention,” but it is not necessary that all the conditions of actual use are duplicated.).

It is well settled that an inventor’s testimony alone is insufficient to establish an earlier reduction to practice. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1170 (Fed. Cir. 2006). Instead, a party seeking to prove an actual reduction to practice must proffer evidence corroborating that testimony. *Id.* “Sufficiency of corroboration is determined by using a ‘rule of reason’ analysis, under which all pertinent evidence is examined when determining the credibility of an inventor’s testimony.” *Id.* (citation omitted). Corroboration may be testimony of a witness, other than the inventor, to the actual reduction to practice, or it may consist of evidence of surrounding facts and circumstances independent of information received from the inventor. *Id.*

Dr. Tung testifies that, in the course of working on “an investigation into the feasibility of commercial process and plant for the large scale manufacture of the next generation low global warming potential refrigerant 2,3,3,3-tetrafluoropropene (‘HFO-1234yf’ or ‘1234yf’)” known as Project Apollo, the inventors “evaluated multiple different pathways for the preparation of 1234yf including using hexafluoropropylene (‘HFP’) as a starting material, among other possible raw materials.” Ex. 2006 ¶ 10. In particular, Dr. Tung worked with Dr. Selma Bektsevic to evaluate the manufacture of 1234yf using a caustic reaction for the dehydrofluorination steps. *Id.* ¶ 14.

Dr. Tung testifies that, in July 2008, he directed Dr. Bektsevic to prepare experiments to investigate the use of the Continuously Stirred Tank Reactor (“CSTR”) concept on the reaction between G-245eb and KOH to

yield 1234yf. *Id.* ¶ 21. Dr. Bektesevic prepared instructions for caustic dehydrofluorination experiments using KOH on July 16, 2008 (“the July 16 Instructions,” Ex. 2011), and provided them to lab technician Angela Mazurkiewicz (now Angela Goodie), who performed the experiments. Ex. 2006 ¶ 22; Ex. 2037 ¶¶ 2, 4. The July 16 Instructions included “discharg[ing] spent KOH from the CSTR” to “collect the spent KOH in scrubber product collection cylinders (‘scrubber PCCs’) containing methylene chloride (‘MeCl₂’),” and noted that “the liquid spent KOH samples must be carefully separated as an analysis of such layers would be performed.” Ex. 2006 ¶ 23; Ex. 2011. The results of these experiments are reported in Dr. Bektesevic’s July 2008 Monthly Technology Report (Ex. 2010), which Dr. Tung received and reviewed. Ex. 2006 ¶¶ 24–26.

On July 29, 2008, Dr. Bektesevic prepared instructions (“the July 29 Instructions,” Ex. 2012) for additional caustic dehydrofluorination experiments using KOH, and provided them to lab technicians Steven Phillips and Ms. Mazurkiewicz, who performed the experiments. Ex. 2006 ¶ 27; Ex. 2037 ¶ 5. According to the July 29 Instructions, the experiments were run in semi-continuous mode, such that 1234yf was continuously removed from the CSTR, and spent KOH was withdrawn periodically from the reactor when the stirrer was stopped. Ex. 2012; Ex. 2037 ¶ 5; Ex. 2006 ¶ 28. Daniel Merkel testifies that he witnessed the experiments conducted by Mr. Phillips and Ms. Mazurkiewicz on July 29–30, 2008. Ex. 2038 ¶ 5. The results of these experiments were reported in Dr. Bektesevic’s August 2008 Monthly Technology Report (Ex. 2013), which Dr. Tung received and reviewed. Ex. 2006 ¶¶ 29–32.

Dr. Tung testifies that, at his direction, “Dr. Bektesevic continued to evaluate the dehydrofluorination reaction pathway, specifically with respect to the use of 236ea” in September 2008. Ex. 2006 ¶ 34. Dr. Bektesevic prepared instructions for additional caustic dehydrofluorination experiments using KOH on September 15, 2008 (“the September 15 Instructions,” Ex. 2015), and provided them to Ms. Mazurkiewicz, who performed the experiments. Ex. 2006 ¶ 34; Ex. 2037 ¶ 6. The September 15 Instructions provided that spent KOH intermittently be taken out of the reactor using a dip-tube and collected in a scrubber PCC pre-filled with MeCl_2 in order to separate and recover spent KOH. Ex. 2015; Ex. 2006 ¶ 36; Ex. 2037 ¶ 6. The results of these experiments were reported in Dr. Bektesevic’s September 2008 Monthly Technology Report (Ex. 2016), which Dr. Tung received and reviewed. Ex. 2006 ¶¶ 35–38.

Patent Owner’s expert, Dr. Lousenberg, testifies that, in his experience, it is typical for someone in the chemical industry “to receive and review monthly/quarterly technology reports to describe experiments.” Ex. 2002 ¶ 144. According to Dr. Lousenberg, the test results reported in Dr. Bektesevic’s July 2008 Monthly Technology Report evidence that “the reaction was successful and demonstrated sufficient utility to continue further experiments.” *Id.* ¶ 146. Dr. Lousenberg further states that “an experiment that provided a conversion of about 50% and a selectivity of about 90% would be sufficiently tested to demonstrate that it will work for a commercial process,” “selectivity of about 90% or better is the best indicator for a useful process,” and that “the July experiment numbers alone suggest a viable commercial process due to the high selectivity.” *Id.* ¶ 148. Dr. Lousenberg also notes that Dr. Bektesevic’s September Monthly

Technology Report provides support for Example 3 in the '282 patent, which “reinforces [his] belief that at least as early as September 2008, but certainly as early as July 2008, the inventors had identified a useful process that could be used commercially and later was described in a patent application.” *Id.* ¶ 152.

Upon consideration of all the evidence, we are persuaded that Patent Owner has met its burden of coming forward with sufficient evidence to corroborate independently Dr. Tung’s testimony that the invention set forth in claims 21–31, 33, 36–42, and 44 of the '282 patent was reduced to practice on or before September 2008. Specifically, Patent Owner’s evidence shows that the inventors performed a process for the manufacture of a fluoroolefin that included dehydrohalogenating a haloalkane in the presence of KOH to produce a haloalkene (Ex. 2010 at 1; Ex. 2013 at 1; Ex. 2006 ¶¶ 21–26, 29–32, 34–38; Ex. 2037 ¶¶ 4, 5, 16; Ex. 2016 at 1), withdrawing a reaction stream comprising spent KOH (Ex. 2010; Ex. 2006 ¶¶ 25, 28, 29, 36; Ex. 2037 ¶¶ 4–6; Ex. 2013; Ex. 2016), and recovering spent KOH (Ex. 2010, Appx. 3; Ex. 2006 ¶¶ 23–26, 30, 34–38; Ex. 2037 ¶¶ 4–6; Ex. 2013, Appx. 1, 3, 5; Ex. 2016). PO Resp. 31–32 (claims 21 and 36). Patent Owner’s evidence also supports a finding that the inventors performed a process, on or before September 2008, that includes all of the elements of claims 22–31 (which depend, directly or indirectly, from claim 21) and claims 37–42 and 44 (which depend, directly or indirectly, from claim 36). *Id.* at 32–37. Thus, we find that Patent Owner’s evidence shows that simultaneous conception and reduction to practice of the invention set forth in claims 21–31, 33, 36–42, and 44 of the '282 patent occurred on or before September 2008.

In the Reply, Petitioner argues that Patent Owner (1) did not perform the claimed process, and (2) did not establish that the invention would work for its intended purpose. Reply 12–16. We address each argument in turn.

First, Petitioner argues that “Patent Owner must demonstrate performance of a process that ‘substantially separate[d] spent [DHA/KOH] from any other materials *in a continuous flow of a fluid* consisting of at least spent [DHA/KOH] resulting from a dehydrofluorination reaction.’” Reply 12. According to Petitioner, “while Patent Owner demonstrated that spent KOH (including dissolved organic) could be withdrawn from a CSTR and collected in a batch container, Patent Owner failed to demonstrate that spent KOH could be substantially separated from any other materials *in a continuous flow of fluid* consisting of spent KOH.” *Id.* at 13.

Petitioner’s argument is premised on Patent Owner’s proposed constructions of “recovering spent KOH” and “reaction stream.” *Id.* at 12. We do not agree with Patent Owner that “reaction stream” should be interpreted to mean “a continuous flow of a fluid consisting of at least spent [DHA or KOH] resulting from a dehydrofluorination reaction,” for the reasons explained above. *See supra* Section II.A.2. Based on the interpretations of the term “spent KOH” and “product stream” set forth above, and contrary to Petitioner’s argument, Patent Owner must demonstrate the performance of a process that separates spent KOH from other material in a volume of material comprising spent KOH resulting from a dehydrofluorination reaction. As Petitioner acknowledges, “Patent Owner has shown separating other materials from spent KOH in a batch collection container.” Reply 12. Accordingly, we do not find Petitioner’s argument that Patent Owner failed to perform the claimed process to be persuasive.

Second, Petitioner argues that Patent Owner did not establish that the invention would work for its intended purpose because Patent Owner did not demonstrate “recovery of spent DHA *and* recycle of unused or regenerated DHA.” Reply 15. According to Petitioner, “Patent Owner’s evidence does not include any experiments demonstrating recycle of DHA,” and “the invention disclosure and other documents demonstrate that the inventors were not certain that the alleged invention would work for its intended purpose of recycling KOH.” *Id.* at 15–16.

We are not persuaded by Petitioner’s argument. The Specification states that “[t]he instant invention relates, at least in part, to a method of increasing cost efficiency for dehydrohalogenation production of a fluorinated olefin by recovering and recycling spent reagent.” Ex. 1001, 2:49–52. The Specification goes on to state that “[r]emoval of spent [DHA] from the reactor allows for facile separation of the organic and the [DHA],” which “leads to lower cost associated with design and operation of complicated and highly specialized separation equipment.” *Id.* at 2:61–65. The Specification also points out that recycling spent DHA “leads to greater efficiency,” and “[i]ncreased productivity is similarly observed if metal fluoride salts are also isolated from the product stream, converted back to the [DHA’s] original form, and recycled to the reaction.” *Id.* at 2:65–3:3.

These disclosures in the Specification indicate that the processes for the manufacture of a fluorinated olefin claimed in the ’282 patent are intended to increase cost efficiency, which is achieved by removing spent DHA from the reactor, but can also include converting recovered metal fluoride salts back to the DHA to increase productivity, and further can include recycling the spent DHA and/or the converted metal fluoride salts

back into the process to increase efficiency. Moreover, the Specification describes embodiments in which there is no recycling of spent DHA because the flow of the recycle stream is zero:

Flow path or stream 8 [in Figure 6] is [a] path for allowing introduction of a recycle stream into the reaction step. In some embodiments, the actual flow of recycle stream 8 is zero, but in preferred embodiments, the recycle stream comprises a relatively low temperature stream comprising a portion of the reaction product stream 6A after it has been cooled and/or separated. The content of recycle stream 8, when present, may include unreacted organic (e.g. HFC-236ea, HFC-245eb) and spent [DHA]. Each may be purified or recovered, as provided herein and recycled.

Ex. 1001, 14:7–17; *see also id.* at 14:37–41 (“Flow path or streams 8A and 8B [in Figure 7] are flow paths for allowing introduction of a recycle stream comprising at least a portion of unreacted feed back or recycled [DHA], as defined herein. In some embodiments, the actual flow of recycle streams 8A and 8B are substantially zero . . .”). The examples in the Specification also do not include recycling spent DHA. *Id.* at 15:18–16:27. This is consistent with the claims of the ’282 patent, wherein all of the independent claims include limitations directed to recovering spent DHA or KOH without reciting a recycling step, and some of the dependent claims further encompass recycling spent DHA back to the reaction (*see, e.g.*, Ex. 1001, Claims 15, 19, 32, 43) and converting the metal fluoride salts to the DHA (*see, e.g., id.*, Claims 17, 34, 46).

Accordingly, we are persuaded that Patent Owner has shown that the subject matter of claims 21–31, 33, 36–42, and 44 was actually reduced to practice before the publication of Smith and Sedat. Thus, we determine that Smith and Sedat do not qualify as prior art as to claims 21–31, 33, 36–42, and 44 of the ’282 patent.

2. *Reasonable Diligence*

Patent Owner also contends that the inventors were reasonably diligent in constructively reducing to practice the subject matter of claims 1–46 during the time period starting before the publication of the references and ending when the claims were constructively reduced to practice upon the filing of the provisional application on October 12, 2010.³ PO Resp. 37–60. In support of its contentions, Patent Owner relies on the Tung Declaration (Ex. 2006), the Goodie Declaration (Ex. 2037), and the Declarations of Thomas Morris (Ex. 2036, “the Morris Declaration”), Bruce Bradford, Esq. (Ex. 2041, “the Bradford Declaration”), and Joseph F. Posillico, Esq. (Ex. 2043, “the Posillico Declaration”). Patent Owner provides several supporting exhibits (Exs. 2008, 2010, 2018, 2019, 2021, 2022, 2024, 2026, 2042). *See id.* Although Patent Owner’s contentions are directed to claims 1–46, we note that we need not resolve whether a constructive reduction to practice occurred with respect to claims 21–31, 33, 36–42, and 44, because Patent Owner demonstrated an actual reduction to practice of those claims. *See supra* II.B.1.

During the period in which reasonable diligence must be shown, there must be a continuous exercise of reasonable diligence. *In re McIntosh*, 230 F.2d 615, 619 (CCPA 1956); *see also Burns v. Curtis*, 172 F.2d 588, 591 (CCPA 1949) (referring to “reasonably continuous activity”). A party alleging diligence must account for the entire critical period. *Griffith v. Kanamaru*, 816 F.2d 624, 626 (Fed. Cir. 1987); *Gould v. Schawlow*, 363

³ The analysis of this argument with respect to claims 1–20, 32, 34, 35, 43, 45, and 46 assumes, without deciding, a date of conception prior to the prior art dates of Smith and Sedat.

F.2d 908, 919 (CCPA 1966). Even a short period of unexplained inactivity is sufficient to defeat a claim of diligence. *Morway v. Bondi*, 203 F.2d 742, 749 (CCPA 1953); *Ireland v. Smith*, 97 F.2d 95, 99–100 (CCPA 1938). In *In re Mulder*, 716 F.2d 1542, 1542–46 (Fed. Cir. 1983), for example, the Federal Circuit affirmed a determination of lack of reasonable diligence where the evidence of record was lacking for a two-day period. Likewise, in *Rieser v. Williams*, 255 F.2d 419, 424 (CCPA 1958), there was no showing of diligence where no activity was shown during the first thirteen days of the critical period.

To satisfy the reasonable diligence requirement, “the work relied on must ordinarily be directly related to reduction to practice of the invention.” *Naber v. Cricchi*, 567 F.2d 382, 385–86 (CCPA 1977) (citing *Anderson v. Scinta*, 372 F.2d 523 (CCPA 1967)); *Gunn v. Bosch*, 181 USPQ 758 (BPAI 1973); *Moore v. Harris v. Hale*, 92 USPQ 187 (BPAI 1951)) (holding that the work done directed an improving oxide and nitride layer deposition techniques generally applicable to all MNOS devices, not merely the drain-source protected device of the claimed invention, did not satisfy the requirement of reasonable diligence). A party alleging diligence must provide corroboration with evidence that is specific both as to facts and dates. *Gould*, 363 F.2d at 920; *Kendall v. Searles*, 173 F.2d 986, 996 (CCPA 1949). The rule of reason does not dispense with the need for corroboration of diligence that is specific as to dates and facts. *Gould*, 363 F.2d at 920; *Kendall*, 173 F.2d at 993; *see also Coleman v. Dines*, 754 F.2d 353, 360 (Fed. Cir. 1985) (“The rule of reason . . . does not dispense with the requirement for some evidence of independent corroboration.”).

Patent Owner must establish reasonable diligence for two critical periods: (1) from just before Smith's May 15, 2009 prior art date,⁴ to October 12, 2010 ("the Smith critical period"); and (2) from just before Sedat's publication on July 16, 2010, to October 12, 2010 ("the Sedat critical period").

Mr. Bruce Bradford, Patent Owner's in-house intellectual property counsel responsible for the Fluorocarbon Process Technology Group, testifies that Dr. Bektesevic used Patent Owner's Worldwide Invention Disclosure System ("WIDS") to submit an "invention disclosure form marked as H0024680 entitled 'Integrated Continuous Process for Dehydrofluorination of 236ea and 245eb'" on August 21, 2009. Ex. 2041 ¶¶ 2, 7; Ex. 2029. Mr. Bradford testifies that Dr. Bektesevic's invention disclosure form was scheduled for review at the next Patent Committee ("PC") meeting, which was set for January 2010. Ex. 2041 ¶ 9. Mr. Bradford further testifies that, as a result of the PC meeting held on January 11, 2010, the PC requested that Dr. Bektesevic draft a detailed disclosure of the invention, which was the regular practice of the PC "if further information was needed for review." *Id.* ¶ 10. Mr. Bradford received the detailed disclosure from Dr. Bektesevic on February 10, 2010. *Id.*; see Ex. 2030.

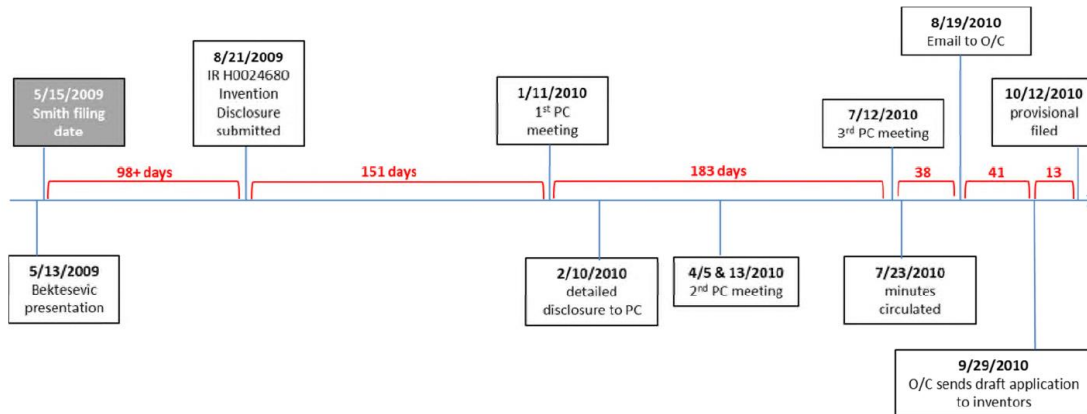
⁴ As already noted, Smith is available as prior art under 35 U.S.C. § 102(e) as of May 15, 2009, and under 35 U.S.C. § 102(a) as of its November 19, 2009 publication date. See Ex. 1003. The parties agree that Smith's earliest prior art date is May 15, 2009. See Pet. 20–21; PO Resp. 38. We note, however, that because the period between May 15, 2009 and October 12, 2010 includes the period between November 19, 2009 and October 12, 2010, our ultimate determination is the same regardless of which date is used to determine the critical period.

Mr. Bradford testifies that at the next PC meeting, held on April 5 and 13, 2010, the PC requested him to “review the invention disclosure form and the detailed disclosure for the ‘Integrated Continuous Process for Dehydrofluorination of 236ea and 245eb’ with an eye to filing.” Ex. 2041 ¶ 11. At the July 12, 2010 PC meeting, the PC requested that Mr. Bradford “send the invention disclosure form and the detailed disclosure to outside counsel for filing.” *Id.* ¶ 12. Mr. Bradford testifies that his paralegal transmitted the invention disclosure and supporting material to Joe Posillico, Patent Owner’s counsel at Fox Rothschild LLP, on August 19, 2010. *Id.* ¶ 15.

Mr. Posillico testifies that he received the documents on August 19, 2010. Ex. 2043 ¶ 5; *see* Ex. 2031. Mr. Posillico testifies that he instructed Eric Sumner to review the documents, and “to prioritize the drafting of this patent application consistent with his other tasks but with a target filing date of September 30, 2010.” Ex. 2043 ¶ 8. Mr. Posillico further testifies that Mr. Sumner worked on the draft application on September 22, 23, 24, 27, and 29, 2010. *Id.* ¶ 9. Mr. Sumner sent the draft application to the inventors for comment and proposed revisions on September 29, 2010, with a request that the inventors provide input by October 6, 2010. *Id.* ¶ 11; *see* Ex. 2032.

Mr. Posillico testifies that, on October 1, 2010, Dr. Bektesevic requested additional time to review the draft, and on October 12, 2010, Dr. Bektesevic responded that “the inventors had discussed the draft and that is was ‘OK to file invention [sic] as is.’” Ex. 2041 ¶ 12; Exs. 2033, 2034. Mr. Posillico instructed Mr. Sumner to file the provisional application, which he did on October 12, 2010. Ex. 2041 ¶ 12; Ex. 2035.

With respect to the Smith critical period, Petitioner provides the following timeline:



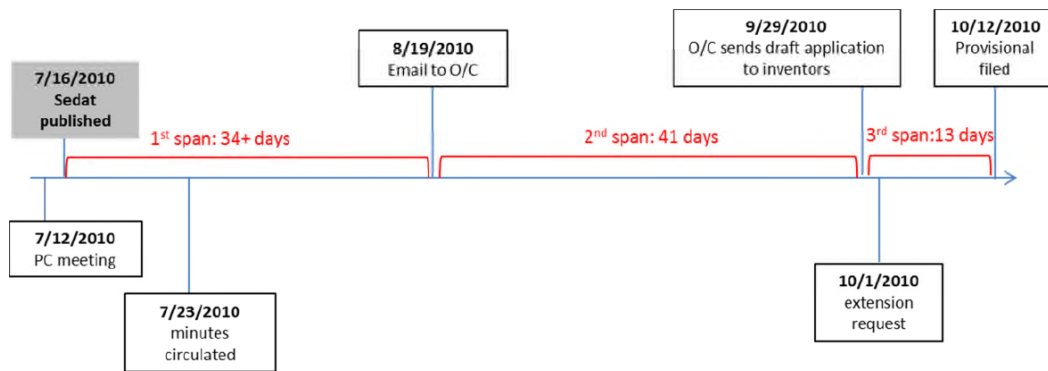
Reply 22. Petitioner argues that Patent Owner “took no action for the 98 days after the Smith filing date until August 21, 2009, when [Dr. Bektsevic] submitted an invention disclosure.” *Id.* at 23. Petitioner argues that the Morris Declaration, which “covers the time span of April 2009 through the fourth quarter of 2011” does not describe “dates of work more specifically than by a particular month.” *Id.* (citing Ex. 2036 ¶¶ 5–10). Petitioner also argues that the Morris Declaration “discusses Patent Owner’s commercialization of 1234yf without ever referencing the process of the ’282 patent.” *Id.* Petitioner further argues that Patent Owner only provides general testimony regarding activities that occurred after the January 2010 PC meeting. *Id.* at 24–25 (citing Exs. 1032, 1033, 1037, 2029, 2030, and 2041).

Based on the record before us, we agree with Petitioner. The evidence that Patent Owner relies upon to explain the activities performed to implement the claimed invention is not specific as to facts and dates for the entire critical period during which diligence was required. For example, Patent Owner does not provide any evidence to account for Dr. Bektsevic’s

actions after the August 21, 2009 submission of the invention disclosure to WIDS. Indeed, the only evidence of activity provided by Patent Owner for the time period between the August 21, 2009 WIDS submission and the January 2010 PC meeting is the Morris Declaration. *See* PO Resp. 40–41. Mr. Morris’s testimony, however, is vague and not sufficiently corroborated.

Specifically, Mr. Morris testifies that (a) sales specifications and sales presentations were worked on in June and July 2009, (b) recommendations for the safe handling and use of 1234yf in automotive air conditioning systems were drafted in August 2009, (c) by September of 2009, there was “a working draft of a whitepaper to brief [Patent Owner’s] top executives regarding 1234yf and to obtain approval for business decisions related to the manufacture of 1234yf,” and (d) Patent Owner “continued to invest in the development of 1234yf” throughout the remainder of 2009 and into 2010. Ex. 2036 ¶¶ 6–10. Mr. Morris does not provide evidence to corroborate these activities, is not specific as to facts and dates, and does not establish that the activities were directed toward the processes claimed in the ’282 patent. Given the absence of specific details concerning the work that was done, Mr. Morris’s testimony amounts to mere pleadings and is insufficient to establish diligence with respect to constructive reduction to practice during this time period. *See In re Harry*, 333 F.2d 920, 922 (CCPA 1964) (Statements that are unsupported by evidence or a showing of facts essentially amounts to mere pleadings.).

With respect to the Sedat critical period, Petitioner provides the following timeline:



Reply 18. Petitioner argues that there was no activity relative to the invention for 27 days between when the minutes for the July 12, 2010 PC meeting were circulated and August 19, 2010. *Id.* at 19. Petitioner argues that the only activity that occurred between August 19, 2010, when outside counsel received instructions to draft the patent application, and September 29, 2010, when the application was sent to the inventors for review, “is that between September 22 and 29 attorneys spent 18.3 hours working on the application,” which “falls far short of continuous.” *Id.* at 20. Petitioner also argues that “Patent Owner has not identified any activities by the inventors to review the draft application or single edit or comment thereto,” other than Dr. Tung’s testimony that he reviewed the draft application when he was available, given his day-to-day responsibilities. *Id.* at 20–21.

Upon consideration of the record before us, we are persuaded that Patent Owner does not establish diligence during the entire Sedat critical period. With respect to the period from the circulation of the July 2010 PC meeting minutes to the submission of instructions to outside counsel to prepare the patent application, Patent Owner notes Mr. Bradford and his paralegal were on vacation from July 26–August 1, 2010, but that “immediately on return from vacation” on August 2, 2010, “Mr. Bradford

instructed his paralegal to proceed with the instructions outlined in the minutes in the ordinary course and in line with other responsibilities.” PO Resp. 43 (citing Ex. 2041 ¶ 14). Mr. Bradford testifies that, at that time, he “was involved in negotiations related to at least two technology transactions including due diligence, and negotiating licensing and supply agreements, which occupied a significant amount of [his] time on a daily basis,” and that his paralegal “would have assisted [him] with those transactions on a daily basis.” Ex. 2041 ¶ 15.

Mr. Bradford does not identify any dates on which he or his paralegal performed work related to the constructive reduction to practice of the claimed invention between August 2 and 19. Although Mr. Bradford states that he was involved in technology transactions that occupied his time, as well as that of his paralegal, he does not provide details such that we can assess the reasonableness of this explanation for this period of inactivity. *See Rieser*, 255 F.2d at 424; *see also Olympus America, Inc. v. Perfect Surgical Techniques, Inc.*, Case IPR2014-00233, slip op. at 20 (PTAB June 8, 2015) (Paper 56) (inventor did not provide any testimony regarding his actions relating to constructive reduction to practice for nineteen days of the critical period, and the Board could not assess the reasonableness of the gap in activity). Because the testimony from Mr. Bradford is not specific as to facts and dates for at least the time period between August 2, 2010 and August 19, 2010, it does not establish diligence during the entire critical period.

Additionally, with respect to the period from the inventors’ receipt of the draft application for review and the filing of the provisional application, Patent Owner argues that “[t]his time period is not an unreasonable time

period for the inventors to review the patent application, given the weekend and their general work requirements.” PO Resp. 44. In support of this argument, Patent Owner cites to the Tung Declaration, in which Dr. Tung testifies that “[d]uring the period of October 1 and October 12, I reviewed the draft application as I was available given my other day to day responsibilities.” Ex. 2006 ¶ 59. Dr. Tung also testifies that he “was copied on an email from Dr. Bektesevic to Mr. Sumner indicating that she had spoken with Mr. Haluk Kopkalli and [Dr. Tung] and providing our approval to file the provisional patent application.” *Id.* ¶ 60; Ex. 2034. In the email, Dr. Bektesevic indicated that “it is OK to file invention as is.” Ex. 2034.

The testimony offered by Dr. Tung concerning the review of the draft patent application is not specific as to facts and dates for the entire critical period during which diligence is required, and does not provide specific evidence to corroborate the work actually performed on the draft patent application between October 1 and October 12, 2010. Dr. Tung does not account for his actions during this period, other than to cite generally to his day-to-day responsibilities, such that we can determine whether any gaps in his activity, and the explanations for such gaps, are reasonable.

Additionally, Patent Owner does not provide any evidence regarding actions taken by the other named inventors (Dr. Bektesevic and Mr. Kopkalli) relating to the constructive reduction to practice of the claimed invention during this portion of the Sedat critical period. Given the absence of specific details concerning the work that was done on the draft patent application, Patent Owner’s proffered evidence is insufficient to establish reasonable diligence during this time period.

For the foregoing reasons, we determine that Patent Owner fails to demonstrate by a preponderance of the evidence that there was a continuous exercise of reasonable diligence to reduce the claimed invention to practice during the Smith and Sedat critical periods. As a result, Patent Owner has not antedated Smith and Sedat based on reasonable diligence leading to constructive reduction to practice. Smith and Sedat, therefore, qualify as prior art to the '282 patent with respect to challenged claims 1–20, 32, 34, 35, 43, 45, and 46.

3. *Conception*

Patent Owner argues that the named inventors conceived of the claimed subject matter “at least as early as March 26, 2008, more than one year before the alleged prior art dates of each of Smith and Sedat.” PO Resp. 26–27. Patent Owner relies on a March 26, 2008 email and attachments prepared by inventor Haluk Kopkalli (“Kopkalli Email,” Ex. 2007) as evidence of conception. *Id.* As support, Patent Owner also proffers the Tung Declaration (Ex. 2006) and the Lousenberg Declaration (Ex. 2002). As set forth in our accompanying Decision on Petitioner’s Motion to Exclude, we have determined that the Kopkalli Email is inadmissible for lack of proper authentication, and thus do not consider it here.

Patent Owner’s demonstration of actual reduction to practice of claims 21–31, 33, 36–42, and 44 demonstrates at least simultaneous conception of the subject matter claimed therein on or before September 2008. In view of our determination that Patent Owner has not proven reasonable diligence leading to constructive reduction to practice, we do not need to determine whether Patent Owner adequately demonstrated

conception with respect to claims 1–20, 32, 34, 35, 43, 45, and 46, and therefore do not reach the issue with respect to those claims.

C. Level of Ordinary Skill in the Art

Petitioner and Patent Owner each propose a particular level of ordinary skill in the art. Pet. 18; PO Resp. 13. In light of the evidence before us, we find that the references themselves represent the level of ordinary skill in the art, and that we need not explicate it further. See *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the level of ordinary skill in the art usually is evidenced by the references themselves); *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (finding that the Board of Patent Appeals and Interferences did not err in concluding that the level of ordinary skill in the art was best determined by the references of record).

D. Obviousness over Sedat

Petitioner asserts that claims 21–27, 30–38, and 41–46 would have been obvious under 35 U.S.C. § 103(a) over Sedat. Pet. 22–36; Reply 1–6. Petitioner explains how Sedat discloses or suggests the claimed subject matter, and also relies on the Declaration of Leo E. Manzer, Ph.D. (“Manzer Declaration,” Ex. 1002). *Id.* Patent Owner disagrees with Petitioner’s assertions and relies on the Lousenberg Declaration. PO Resp. 13–19.

To prevail on its patentability challenge, Petitioner must establish facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). A claim is unpatentable under 35 U.S.C. § 103 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 having ordinary skill in the art to which the subject

matter pertains. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). A party that petitions the Board for a determination of obviousness must show that “a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *Procter & Gamble Co. v. Teva Pharm. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009) (quoting *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007)).

1. Overview of Sedat

Sedat is directed to a process for the preparation of fluoroolefin compounds, particularly hydrofluoropropenes. Ex. 1005, 1.⁵ The process described in Sedat includes: (i) in a stirred reactor containing an aqueous reaction medium, contacting at least one compound comprising from three to six carbon atoms, at least two fluorine atoms, and at least one hydrogen atom with potassium hydroxide (KOH) to form the desired (hydro)fluoroolefin compound and potassium fluoride (KF); (ii) in an aqueous medium, contacting the KF formed in step (i) with calcium hydroxide (Ca(OH)₂) to give KOH and to precipitate calcium fluoride (CaF₂); (iii) separating the CaF₂ precipitated in step (ii) from the reaction medium; and (iv) optionally, recycling the reaction medium back to step (i), after optional adjustment of the KOH concentration. *Id.* at 4–5. Sedat states that “[a]dvantageously, step (ii) is carried out in the reaction medium from step (i) comprising water, potassium hydroxide and potassium fluoride.” *Id.* at 8. According to Sedat, “[t]he present invention thus makes it possible to obtain an advantageous

⁵ The cited page numbers in Exhibit 1005 refer to the numbers at the top of each page, rather than those added by Petitioner at the bottom.

process since, on the one hand, potassium hydroxide is more reactive than calcium hydroxide in the dehydrofluorination reaction and, on the other hand, calcium fluoride is a reusable by-product.” *Id.* at 5.

Sedat further states that the described process can be used to obtain 2,3,3,3-tetrafluoropropene (HFO-1234yf) by the dehydrofluorination of 1,2,3,3,3-pentafluoropropane with KOH, and can also be used to obtain 1,2,3,3,3-pentafluoropropene (HFO-1225ye) by dehydrofluorination of 1,1,1,2,3,3-hexafluoropropane (HFC-236ea) with KOH. *Id.* at 6–7.

2. *Claims 21–27, 30, 31, 33, 36–38, 41, 42, and 44*

As set forth above, we determine that Sedat is not prior art as to claims 21–31, 33, 36–42, and 44 of the ’282 patent. *See supra* Section II.B.2. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claims 21–27, 30, 31, 33, 36–38, 42, and 44 would have been obvious over Sedat under 35 U.S.C. § 103(a).

3. *Claims 32, 34, 35, 43, 45, and 46*

Claims 32, 34, and 35 depend, directly or indirectly, from claim 21. Claims 43, 45 and 46 depend, directly or indirectly, from claim 36. Thus, we must analyze whether Petitioner has shown, by a preponderance of the evidence, that Sedat teaches all of the elements of claims 21 and 36, as well as the additional elements that appear in dependent claims 32, 34, 35, 43, 45, and 46. The parties focus their arguments on the “recovering spent KOH” element of claims 21 and 36. As to the other elements of claims 21 and 36, we have reviewed the evidence and arguments presented in the Petition and find that Petitioner has shown sufficiently that those elements are disclosed. Pet. 22–27.

Petitioner contends that Sedat teaches “recovering spent KOH” because it describes “recovery of unreacted KOH remaining after the dehydrohalogenation reaction as well as recovery of KOH regenerated from the metal salt by-product KF.” Pet. 23. Petitioner contends that “*Sedat* teaches that both KOH and KF are present in the reaction medium taken from the dehydrohalogenating reactor.” *Id.* (citing Ex. 1005, 8:13–17). According to Petitioner, Sedat describes the following steps that result in recovering spent KOH from other components in the reaction mixture:

(1) introducing a suspension of calcium hydroxide to the reaction medium, which contains KOH and KF, resulting in the conversion of KF to KOH and the precipitation of CaF_2 , (2) separating CaF_2 from the reaction medium, and (3) collecting and concentrating aqueous KOH in an evaporator before recycling KOH back to the dehydrohalogenation reactor.

Id. at 23–24 (internal citations omitted).

Patent Owner argues that “*Sedat* is silent as to the presence of anything else in the reaction stream and thus does not provide any mechanism (e.g., a decanter)” that a person having ordinary skill in the art would understand could separate the spent KOH from anything in the reaction stream in order to recover spent KOH. PO Resp. 14 (citing Ex. 2002 ¶ 112). Patent Owner argues that a person having ordinary skill in the art “would understand that organics may be entrained in the aqueous phase ‘reaction medium’ as a result of the shear mixing in Sedat’s reactor (1) in order to facilitate the reaction and there would be no phase separation under these conditions,” but “irrespective of what is in the reaction medium, *Sedat* does not teach or suggest any way to ‘separate’ spent DHA or KOH from anything else in the reaction medium.” *Id.* at 14–15 (citing Ex. 2002 ¶ 113). Patent Owner further argues that “[t]he only separation disclosed by Sedat

appears to be the separation of calcium fluoride from converted KOH” after spent KOH is regenerated with calcium hydroxide, which a person having ordinary skill in the art would not interpret as “recovering spent KOH” because “the calcium fluoride would not be separating ‘spent KOH’ or ‘spent DHA’ from anything else in the reaction stream.” *Id.* at 15 (citing Ex. 2002 ¶ 114). According to Patent Owner, “the separation of the calcium fluoride in Sedat necessarily occurs after the KF is gone as it has been converted to KOH.” *Id.*

Based on our review of the record, we find Patent Owner’s argument that Sedat does not disclose recovering spent KOH as is required by claims 21 and 36 to be persuasive. Sedat describes a three step process, wherein step (i) is a dehydrofluorination reaction, step (ii) involves contacting the potassium fluoride that results from step (i) with calcium hydroxide to give KOH and to precipitate calcium fluoride, and in step (iii), the precipitated calcium fluoride is separated from the reaction medium. Ex. 1005, 4–5. Sedat teaches that “[a]dvantageously, step (ii) is carried out in the reaction medium from step (i) comprising water, [KOH] and [KF],” and “[t]he calcium fluoride precipitated in step (ii) is separated from the reaction medium, for example by filtration and/or settling.” *Id.* at 8–9. After the calcium fluoride separation, “the reaction medium with or without the calcium fluoride washing waters may be recycled to step (i) after optional adjustment of the potassium hydroxide content.” *Id.* at 9.

As set forth above, we construed “recovering spent KOH” to mean “separating spent KOH from other materials in the reaction stream,” and “reaction stream” to mean “a volume of material comprising spent KOH resulting from a dehydrofluorination reaction.” *See supra* Section II.A. In

Sedat, the reaction medium resulting from the dehydrofluorination reaction in step (i) comprising water, KOH, and KF is “a volume of material comprising spent KOH resulting from a dehydrofluorination reaction,” and, therefore, is a reaction stream as required by claims 21 and 36. As Patent Owner notes, however, Sedat does not describe separating spent KOH from other materials in the reaction stream. PO Resp. 14–16. Instead, Sedat describes first reacting the KF in the reaction stream with calcium hydroxide to regenerate KOH and precipitate calcium fluoride, and then separating the calcium fluoride from the other materials in the reaction stream by filtration and/or settling. That regenerated KOH is in the stream after the calcium fluoride precipitate is separated out is not separating spent KOH from other materials in a volume of material comprising spent KOH resulting from a dehydrofluorination reaction, and, thus, does not demonstrate recovering spent KOH from a reaction stream comprising KOH as is required by the claims. See Ex. 2002 ¶ 114 (person having ordinary skill in the art “would not interpret this separation as ‘recovering spent KOH’” because “the calcium fluoride would not be separating ‘spent KOH’” from everything else in the reaction stream). Moreover, the stream that remains after the calcium fluoride is separated in Sedat step (iii) is not “a volume of material that results from a dehydrofluorination reaction” because it results from the calcium fluoride separation.

In its Reply, Petitioner additionally argues that “it would have been obvious for a [person having ordinary skill in the art] to remove entrained organics using a phase separator such as a decanter between the dehydrohalogenating reactor 1 [step (i) in Sedat] and the KF conversion reactor 6 [step (ii) in Sedat], shown in Figure 1.” Reply 2. Petitioner points

to Dr. Lousenberg's testimony that "it would be undesirable to have dissolved or entrained organics present in the KF conversion reactor 6 because 'it's not doing anything'" and argues that a person having ordinary skill in the art "would be motivated to separate dissolved organics from the aqueous stream exiting reactor 1 before it enters the conversion reactor 6, such as by using a phase separator between steps (i) and (ii) of Sedat." *Id.* at 3. Petitioner argues that "[t]he separated dissolved organics could be processed using conventional processing steps" and that "spent KOH could be withdrawn from the separator and introduced to the reactor 6." *Id.* at 4.

Petitioner did not include this argument in its Petition, raising it for the first time in the Reply. *See* Pet. 22–27. Our rules, however, provide that a petitioner must include "[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence including material facts, and the governing laws, rules, and precedent." 37 C.F.R. § 42.22(a). Our rules also state that "[a] reply may only respond to arguments raised in the corresponding . . . patent owner response." *Id.* § 42.23(b). Practice relating to replies is addressed in the Office Patent Trial Practice Guide:

While replies can help crystallize issues for decision, a reply that raises a new issue or belatedly presents evidence will not be considered and may be returned. The Board will not attempt to sort proper from improper portions of the reply. Examples of indications that a new issue has been raised in a reply include new evidence necessary to make out a *prima facie* case for the patentability or unpatentability of an original or proposed substitute claim, and new evidence that could have been presented in a prior filing.

Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012).

Petitioner's Reply argument is not simply a response to Patent Owner's arguments. In the Patent Owner Response, Patent Owner introduced evidence that Petitioner failed to make a case of obviousness because Sedat does not teach, suggest, or disclose "recovering spent KOH." PO Resp. 13–16. In the Reply, Petitioner presents new arguments necessary to make its case, not arguments designed to support or confirm the case it presented in the Petition. As explained above, the case presented in the Petition is that Sedat teaches "recovering spent KOH" because it describes "recovery of unreacted KOH remaining after the dehydrohalogenation reaction as well as recovery of KOH regenerated from the metal salt by-product KF." Pet. 23. Petitioner's argument in the Reply is that a person having ordinary skill in the art would have modified the Sedat process to include a phase separator between steps (i) and (ii) in order to separate dissolved organics from the reaction stream. Reply 2–6. This is a new theory of obviousness that Petitioner did not include in its Petition, and is therefore an attempt to argue a new case.

At the hearing, Petitioner cited two cases in support of its contention that the arguments presented for the first time in the reply were proper. Tr. 97:12–99:2 (citing *Genzyme Therapeutic Products Ltd. P'ship v. Biomarin Pharma. Inc.*, 825 F.3d 1360, 1366 (Fed. Cir. 2016) and *Volkswagen Group of Am., Inc. v. Emerachem Holdings, LLC*, Case IPR2014-01555, slip op. at 5 (PTAB October 9, 2015) (Paper 36)). Neither case supports the proposition that a reply may present a new theory of obviousness necessary to make Petitioner's case. *Genzyme* relates to evidence served with the reply in response to an argument made in the patent owner response, and the Board's use of that evidence in the final written

decision, not to the introduction of a new theory of unpatentability in a reply. *Genzyme*, 825 F.3d at 1368 (Although characterized “as being about the sufficiency of notice and an opportunity to be heard, the substance of *Genzyme*’s argument is to challenge the propriety of the Board’s use, for any purpose, of a reference that was not part of the combinations set forth in the institution decision.”). *Volkswagen*, which is a Board order authorizing the filing of a motion to exclude, confirms that a proper reply may rely on evidence already cited in the petition, or new evidence, in order to respond to arguments made in the patent owner response. *Volkswagen*, Case IPR2014-01555, slip op. at 5. It does not state that a petitioner may reply to a patent owner response by introducing a new theory of obviousness, as Petitioner has done here.

Because Petitioner waited until the Reply to present the argument that a person having ordinary skill would have modified Sedat, Patent Owner was denied the opportunity to file responsive evidence. Consideration by the Board of the new arguments in the Reply would be unfair to Patent Owner. Petitioner could have presented this argument with the Petition. Accordingly, we decline to consider the portion of the Reply that sets forth this new argument. *See* Office Trial Practice Guide, 77 Fed. Reg. at 48,767.

After considering Petitioner’s and Patent Owner’s positions, as well as their supporting evidence, we are not persuaded that Petitioner has demonstrated that Sedat discloses “recovering spent KOH” as required by independent claims 21 and 36. Consequently, we determine that Petitioner has not shown, by a preponderance of the evidence, that claims 32, 34, and 35 that depend, directly or indirectly, from claim 21, or claims 43, 45 and 46

that depend, directly or indirectly from claim 36, would have been obvious over Sedat.

E. Obviousness over Smith and Sedat

Petitioner asserts that claims 1–20, 21, 28, 29, 36, 39, and 40 would have been obvious under 35 U.S.C. § 103(a) over the combination of Smith and Sedat, and relies on the Manzer Declaration in support of its assertions. Pet. 36–60; Reply 7–12. Patent Owner disagrees with Petitioner’s assertions, and relies on the Lousenberg Declaration. PO Resp. 19–24.

1. Overview of Smith

Smith is directed to a process for preparing 2,3,3,3-tetrafluoropropene (“HFO-1234yf” or “1234yf”). Ex. 1003, 1.⁶ The process described in Smith includes: (1) contacting 1,1,2,3,3,3-hexafluoropropene (“HFP” or “1216”) with hydrogen in the presence of a catalyst to produce 1,2,3,3,3-hexafluoropropane (“236ea”); (2) dehydrofluorinating 236ea to produce 1,2,3,3,3-pentafluoropropene (“1225ye”); (3) contacting 1225ye with hydrogen in the presence of a catalyst to produce 1,2,3,3,3-pentafluoropropane (“245eb”); and (4) dehydrofluorinating 245eb to produce 1234yf. *Id.* at 1–2. Smith states that the products from steps (1), (2), (3), and/or (4) “may be subjected to a purification step” including “separation of the desired product(s) or reagents by one or more distillation, condensation or phase separation steps and/or by scrubbing with water or aqueous base.” *Id.* at 2.

⁶ The cited page numbers in Exhibit 1003 refer to the numbers at the bottom of each page that are original to the document, rather than those added by Petitioner.

According to Smith, dehydrofluorination steps (2) and (4) can be carried out by contacting 236ea and/or 245eb with a base, where “the base is a metal hydroxide or amide (preferably a basic metal hydroxide or amide, e.g., an alkali or alkaline earth metal hydroxide or amide).” *Id.* at 11. Smith states that “[a] preferred base is an alkali metal hydroxide selected from the group consisting of lithium hydroxide, sodium hydroxide and potassium hydroxide, more preferably, sodium hydroxide and potassium hydroxide and most preferably potassium hydroxide.” *Id.* at 12.

2. *Claims 21, 28, 29, 36, 39, and 40*

As set forth above, we determine that Smith and Sedat are not prior art as to claims 21–31, 33, 36–42, and 44 of the ’282 patent. *See supra* Section II.B.2. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claims 21, 28, 29, 36, 39, and 40 would have been obvious over the combined teachings of Smith and Sedat under 35 U.S.C. § 103(a).

3. *Claims 1–20*

Petitioner contends that “*Smith* discloses steps (a)–(c) and *Sedat* discloses steps (d) and (e)” of independent claim 1, and that “*Smith* discloses steps (a) and (b), and *Sedat* teaches steps (c) and (d)” of independent claim 10. Pet. 36, 46. Step (e) of claim 1 and step (d) of claim 10 each recite “recovering spent [DHA].” Petitioner makes the same arguments with respect to the “recovering spent [DHA]” limitation of claims 1 and 10 as set forth with respect to the “recovering spent KOH” limitation of claims 21 and 36. *Id.* at 38–39, 48. For the reasons set forth above, we are not persuaded that Petitioner has established that Sedat teaches “recovering spent [DHA]” as is required by claims 1 and 10. *See supra* Section II.D.3. Petitioner does not rely on Smith with respect to this limitation.

Consequently, we determine that Petitioner has not shown, by a preponderance of the evidence, that independent claim 1, and claims 2–9 that depend, directly or indirectly, therefrom, and independent claim 10, and claims 11–20 that depend, directly or indirectly therefrom, would have been obvious over the combination of Smith and Sedat.

III. CONCLUSION

For the reasons given, we are not persuaded that Petitioner has shown by a preponderance of the evidence that claims 21–27, 30–38, and 41–46 of the '282 patent are unpatentable as obvious over Sedat, or that claims 1–20, 21, 28, 29, 36, 39, and 40 of the '282 patent are unpatentable as obvious over the combination of Smith and Sedat.

IV. ORDER

In consideration of the foregoing, it is

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1–46 of the '282 patent are unpatentable; and

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

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