

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEXICHEM UK LTD.,
Petitioner,

v.

THE CHEMOURS COMPANY FC, LLC,
Patent Owner.

Case IPR2019-00529
Patent 8,147,709 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and
SHELDON M. McGEE, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314(a)

I. INTRODUCTION

Mexichem UK Ltd.¹ (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–11 of U.S. Patent No. 8,147,709 B2 (“the ’709 patent,” Ex. 1001). Paper 1 (“Pet.”). The Chemours Company FC, LLC (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314; see 37 C.F.R. § 42.4. Upon consideration of the Petition, the Preliminary Response, and the evidence of record, we determine that Petitioner has not established a reasonable likelihood of prevailing with respect to the unpatentability of claims 1–11 of the ’709 patent. Accordingly, we deny the Petition and do not institute an *inter partes* review.

A. Related Proceedings

The parties state that the ’709 patent was challenged previously by Daikin Industries, Ltd. and Daikin America, Inc. in IPR2016-00452, which currently is on appeal at the U.S. Court of Appeals for the Federal Circuit (Appeal No. 18-1389). Pet. 3; Paper 6, 1.

B. The ’709 patent

The ’709 patent, titled “Compositions comprising 3,3,3-trifluoropropyne,” is directed to “a composition comprising HFO-1234yf

¹ Petitioner lists Mexichem UK Ltd., Mexichem Amanco Holding, S.A. de C.V., Mexichem, S.A.B. de C.V., Mexichem Soluciones Integrales Holding, S.A. de C.V., Mexichem Fluor, Inc., Mexichem Fluor Comercial, S.A. de C.V., and Mexichem Fluor, S.A. de C.V. (collectively “Mexichem”) as the real parties-in-interest. Pet. 2–3.

[also known as 2,3,3,3-tetrafluoropropene] and at least one additional compound” selected from a group of twenty-five compounds, including 3,3,3-trifluoropropyne, HFO-1234ze, and HFO-1243zf.² Ex. 1001, 1:39–49. The ’709 patent explains that environmental regulations “have led to the need for new compositions for use in refrigeration, air-conditioning, and heat pump apparatus,” especially compositions having low global warming potential. *Id.* at 1:28–31. One such composition is HFO-1234yf, which may be made by catalytic dehydrofluorination of HFC-245eb (or 1,1,1,2,3-pentafluoropropane) (with “HFC” meaning hydrofluorocarbon). *Id.* at 1:13–25, 4:24–25, Fig. 1. The ’709 patent states: “Applicants have found that in preparing such new low global warming potential compounds, such as HFO-1234yf, that certain additional compounds are present in small amounts.” *Id.* at 1:36–39. According to the ’709 patent, the inventive composition “contains less than about 1 weight percent of the at least one additional compound” noted above. *Id.* at 1:48–50.

C. Challenged Claims

Petitioner challenges claims 1–11 (“the challenged claims”) of the ’709 patent. Claim 1 is illustrative of the challenged claims and is reproduced below.

1. A composition comprising HFO-1234yf and at least one additional compound selected from the group consisting of HFO-1234ze, HFC-254eb, HFC-254fb, HFO-1243zf, HFC-245eb, HFC-245fa, HFC-245cb, HFC-236cb, HFC-236ea, HFC-

² HFO-1243zf is another name for the compound 1,1,1-trifluoropropene, and HFO-1234ze is another name for the compound E- or Z-1,3,3,3-tetrafluoropropene. Ex. 1001, 3:35–57, Table 1 (listing HFC/HFO code, structure, and chemical name for each additional compound). The “E-” and “Z-” notations refer to the fact that HFO-1234ze exists as the E-isomer, Z-isomer, or a combination of both isomers. *See, e.g., id.* at 11:64–67.

236fa, HFC-227ea, HFC-227ca, HFO-1225yc, HFO-1225zc, HFO-1225ye, 3,3,3-trifluoropropyne, methane, ethane, propane, HFC-23, HFC-143a, HFC-134, HFC-134a, HFO-1132a, and FC-1216: wherein the composition comprises 3,3,3-trifluoropropyne and the total amount of additional compounds in the composition comprising HFO-1234yf ranges from greater than zero weight percent to less than one weight percent.

Id. at 14:18–29.

D. The Asserted Grounds of Unpatentability

Petitioner challenges the patentability of claims 1–11 on the following grounds:

Reference(s)	Basis	Challenged Claim(s)
Rao '434 ³	§ 102	1–11
Rao '781 ⁴	§ 102	1–11
Rao '597 ⁵	§ 102	1–11
Nose ⁶ in view of ARI Standards ⁷	§ 103	1–4
Rao '434 in view of ARI Standards	§ 103	1–11
Rao '781 in view of ARI Standards	§ 103	1–11
Rao '597 in view of ARI Standards	§ 103	1–11

³ U.S. 7,833,434 B2, issued Nov. 16, 2010 (Ex. 1024).

⁴ U.S. 7,722,781 B2, issued May 25, 2010 (Ex. 1026).

⁵ U.S. 8,288,597 B2, issued Oct. 16, 2012 (Ex. 1025).

⁶ WO 2010/050373 A2, published May 6, 2010 (Ex. 1032).

⁷ Sundaresan, ARI-STANDARD 700, SPECIFICATIONS FOR FLUOROCARBON REFRIGERANTS, CFC ALTERNATIVES: INTERNATIONAL CONFERENCE ON CFC AND HALON ALTERNATIVE (1989) (Ex. 1018); AHRI STANDARD 700 WITH ADDENDUM 1, 2016 STANDARD FOR SPECIFICATIONS FOR REFRIGERANTS, AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE (2016) (Ex. 1019); and AHRI STANDARD 210/240, 2017 STANDARD FOR PERFORMANCE RATING OF UNITARY AIR-CONDITIONING & AIR-SOURCE HEAT PUMP EQUIPMENT (2017) (Ex. 1020) (collectively the “ARI Standards”).
See Pet. 44.

Reference(s)	Basis	Challenged Claim(s)
Tung ⁸ in view of ARI Standards	§ 103	1
Mukhopadhyay ⁹ in view of ARI Standards	§ 103	1

Petitioner relies on the Declaration of Professor Graham Sandford (“the Sandford Declaration,” Ex. 1005) in support of its contentions. Patent Owner relies on the Declaration of Dr. Joseph S. Thrasher (“the Thrasher Declaration,” Ex. 2003) in support of its Preliminary Response.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner argues that a person having ordinary skill in the art (“POSITA”) at the time of the ’709 patent would have had “a Ph. D. in chemistry, along with extensive training and at least three years of work experience in the operation of processes using” hydrogen fluoride, i.e., “HF.” Pet. 11 (citing Ex. 1005 ¶ 26). Petitioner further asserts that “[t]he POSITA would understand the proper methods and environments for performing fluorination using HF, such as reactor vessel materials and construction, gas handling, safe working procedures, and fluorination and dehydrohalogenation processes.” *Id.* (citing Ex. 1005 ¶ 25).

Patent Owner disputes Petitioner’s basis for the level of ordinary skill in the art, arguing that “the subject matter of the claims is not so limited as to exclusively cover compositions of HFO-1234yf produced with hydrogen fluoride” and “[f]luorination and dehydrohalogenation are only specific methods of producing HFO-1234yf, not the exclusive means.” Prelim.

⁸ U.S. 8,084,653 B2, issued Dec. 27, 2011 (Ex. 1027).

⁹ U.S. 9,035,111 B2, issued May 19, 2015 (Ex. 1028).

Resp. 7–8. Patent Owner contends that “a POSITA is a person with a masters or doctorate degree in chemistry and/or chemical engineering, and having at least 3 years of experience working on the research, development, manufacture and formulations of HFC, HCFC and HFO compounds and mixtures.” *Id.* at 8 (citing Ex. 2003 ¶ 23). Patent Owner’s declarant Dr. Thrasher testifies, however, that he has “reviewed Dr. Sandford’s definition of a person of ordinary skill in the art” and his opinions “do not change under Dr. Sandford’s definition.” Ex. 2003 ¶ 24.

We agree with the parties that a POSITA would have had an advanced degree in chemistry or chemical engineering, and experience in the research, development, and/or manufacture of hydrofluorocarbons (HFC) and hydrofluoroolefins (HFO), which is consistent with the level of ordinary skill in the art at the time of the invention as reflected in the prior art in this proceeding. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))). Our determination regarding Petitioner’s challenge does not turn on the differences between Petitioner’s and Patent Owner’s definitions, and we note that our conclusions would be the same under either definition.

B. Claim Interpretation

We apply the same claim construction standard applied in civil actions under 35 U.S.C. § 282(b), which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). 37 C.F.R. § 42.100(b); *see also Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings*

Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (applicable to *inter partes* reviews filed on or after November 13, 2018). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” *Phillips*, 415 F.3d at 1312. “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1313.

Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Petitioner does not propose a construction for any of the claim terms. Pet. 21–22. For purposes of this Decision, based on the record before us, we determine that no claim term requires explicit construction.

C. Overview of the Prior Art

1. Rao ’434

Rao ’434 is directed “to the production of tetrafluoropropenes and more specifically to the production of 2,3,3,3-tetrafluoropropene (HFC-1234yf) and 1,3,3,3-tetrafluoropropene (HFC-1234ze) from 1,1,1,2,3-pentafluoropropane (HFC-245eb).” Ex. 1024, 1:10–14. Rao ’434 discloses that the industry has been seeking to replace refrigerants because the Montreal Protocol phased out ozone depleting chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). *Id.* at 1:16–19. According to Rao ’434, HFC-1234yf and HFC-1234ze have been identified as potential

refrigerants because they have zero ozone depletion and low global warming potential. *Id.* at 1:32–39. In view of this, Rao '434 discloses that new manufacturing processes are needed for these compounds. *Id.* at 1:40–41.

Rao '434 discloses preparing HFC-245eb via hydrogenation of CFC-215bb over a catalyst or via hydrogenation of $\text{CF}_3\text{CF}=\text{CFH}$. *Id.* at 1:55–60. The HFC-245eb is then pyrolyzed in the absence of a catalyst within a reactor to produce HFC-1234yf and HF-1234ze. *Id.* at 1:44–54, 2:53–55. Rao '434 discloses that “[t]he reactor effluent after pyrolysis of HFC-245eb typically includes HF, CHF_3 , $\text{CH}_2=\text{CF}_2$, $\text{CF}_3\text{CF}=\text{CH}_2$, $\text{CF}_3\text{CH}=\text{CHF}$, $\text{CF}_3\text{CH}=\text{CF}_2$ and small amounts of other byproducts and any unconverted $\text{CF}_3\text{CHFCFH}_2$.” *Id.* at 3:58–61.

2. Rao '781

Rao '781 is directed “to the production of tetrafluoropropenes and more specifically to the production of 2,3,3,3-tetrafluoropropene (HFC-1234yf) and 1,3,3,3-tetrafluoropropene (HFC-1234ze) from 1,1,1,2,3-pentafluoropropane (HFC-245eb).” Ex. 1026, 1:11–15. Rao '781 also discloses that HFC-1234yf and HFC-1234ze have been identified as potential refrigerants in view of phasing out ozone depleting CFCs and HCFCs. *Id.* at 1:19–22, 1:36–43. The manufacturing process disclosed by Rao '781 “comprises (a) dehydrofluorinating HFC-245eb in the presence of a dehydrofluorination catalyst to produce a product mixture comprising HFC-1234yf and HFC-1234ze; and (b) recovering said HFC-1234yf and HFC-1234ze from the product mixture produced in (a).” *Id.* at 1:50–55.

Rao '781 teaches that its invention provides compositions “which comprise the Z-isomer of HFC-1234ze and HF, wherein the HF is present in an effective amount to form an azeotropic combination with the Z-HFC-

1234ze” and “these compositions comprise from about 77.0 mole percent to about 48.5 mole percent HF and from about 23.0 mole percent to about 51.5 mole percent Z-HFC-1234ze.” *Id.* at 5:4–14. Rao ’781 also discloses that “near azeotrope compositions containing HF and Z-HFC-1234ze may also be formed” and “[c]ompositions may be formed that consist essentially of azeotrope combinations of hydrogen fluoride with Z-HFC-1234ze.” *Id.* at 5:15–16, 5:40–42.

3. *Rao ’597*

Rao ’597 is directed to “processes for the production of fluorinated olefins.” Ex. 1025, 1:7–8. Similar to Rao ’434 and Rao ’781, Rao ’597 discloses that the refrigeration industry has been seeking refrigerants to replace CFCs and HCFCs. *Id.* at 1:10–14. Specifically, Rao ’597 discloses:

a process for the manufacture of hydrofluoroolefins of the structure $\text{CF}_3\text{CF}=\text{CHY}$, wherein Y can be H or F, comprising reacting at least one fluoropropane reactant of the structure $\text{CF}_3\text{CFXCFY}'\text{H}$, wherein X can be either F or H, and Y' can be either F or H, provided that both X and Y' are not both F, with a basic aqueous solution in the presence of a nonaqueous, nonalcoholic solvent, and in the presence of a phase transfer catalyst.

In certain embodiments, the hydrofluoroolefin produced by the disclosed embodiments are 1,2,3,3,3-pentafluoro-1-propene (HFC-1225ye) (both isomers) and 2,3,3,3-tetrafluoro-1-propene (HFC-1234yf), each having zero ozone depletion and low global warming potential and have been identified as potential refrigerants.

Id. at 2:6–19. In one embodiment Rao ’597 discloses “the manufacture of 2,3,3,3-tetrafluoro-1-propene (HFC-1234yf) from 1,1,1,2,3-pentafluoropropane (HFC-245eb).” *Id.* at 3:16–18. Rao ’597 discloses an example for the dehydrofluorination of HFC-245eb to HFC-1234yf that

results in about 247 gm of crude product “containing 96.1% 1234yf, 0.5% Z-1234ze, 0.1% E-1234ze and 2.9% unreacted $\text{CF}_3\text{CHFCH}_2\text{F}$.” *Id.* at 7:15–32.

4. Nose

Nose is directed “to a process for preparing 2,3,3,3-tetrafluoropropene” (HFC-1234yf). Ex. 1032, 1:5–12. Nose teaches that prior processes for preparing HFC-1234yf had various problems, such as not providing a satisfactory yield, or being too expensive for industrial scale production. *Id.* at 1:13–35, 2:1–4. In view of this, the main object of Nose “is to provide an industrially applicable process for efficiently preparing 2,3,3,3-tetrafluoropropene.” *Id.* at 2:19–21. Specifically, Nose discloses:

The present inventors conducted extensive research to achieve the above object, and found that by using easily available 3,3,3-trifluoropropyne as a starting material, and allowing the 3,3,3-trifluoropropyne to react with hydrogen fluoride while heating, a product containing 2,3,3,3-tetrafluoropropene can be prepared in a single step. The present inventors also found that by dividing the obtained product into a component containing the target 2,3,3,3-tetrafluoropropene and unreacted 3,3,3-trifluoropropyne, and a component containing a by-product, and then subjecting the component containing 2,3,3,3-tetrafluoropropene and 3,3,3-trifluoropropyne to distillation or like separating means, the target 2,3,3,3-tetrafluoropropene and 3,3,3-trifluoropropyne (i.e., a starting material) can be obtained. The present inventors also found that by subjecting the component containing a by-product to a dehydrofluorination reaction, a portion of the component can be converted into the target 2,3,3,3-tetrafluoropropene and the starting material 3,3,3-trifluoropropyne, and further found that by dividing the resulting product into a component containing 2,3,3,3-tetrafluoropropene and 3,3,3-trifluoropropyne and a component containing a by-product, and then subjecting the component containing 2,3,3,3-tetrafluoropropene and 3,3,3-trifluoropropyne to a separation treatment, 2,3,3,3-tetrafluoropropene and 3,3,3-trifluoropropyne can be separated into each compound.

Id. at 2:23–35, 3:1–12.

Nose discloses various experimental results in which the preparation steps of synthesizing 2,3,3,3-tetrafluoropropene from 3,3,3-trifluoropropyne and dehydrofluorinating 1,3,3,3-tetrafluoropropene were varied. *Id.* at 12:15–18, 16:20–24, 17:30–35, 18:1–3, Fig. 1. In one experiment, a catalyst obtained by fluorinating a chromium oxide (represented by the composition formula $\text{CrO}_{2.0}$) was placed in a tubular reactor having an inside diameter of 15 mm and a length of 1 m. *Id.* at 20:6–8, 21:21–25. The reactor was maintained at atmosphere pressure and 350°C, anhydrous HF was supplied at a flow rate of 60 cc/min for 2 hours and then stopped, then nitrogen gas was supplied at a flow rate of 60 cc/min for another 2 hours and then stopped, and $\text{CF}_3\text{CF}_2\text{CH}_3$ was supplied at a flow rate of 30 cc/min and a temperature of 380°C. *Id.* at 21:25–34. An outflow was produced “[t]wo hours after the reaction temperature reached a predetermined point” and the outflow was analyzed via gas chromatography. *Id.* at 21:34–35, 22:1–2. The outflow contained 2.5% $\text{CF}_3\text{C}\equiv\text{CH}$, 82.8% HFC-1234yf, 2% HFC-1234ze-E, 0.7% HFC-1234ze-Z, 10.8% HFC-245cb, 0.8% HFC-245fa, and 0.4% “Others.” *Id.* at 22:2–4, Table 2.

5. ARI Standards

The 1989 “ARI–Standard 700” states that it “is designed to aid in the conservation of refrigerants by providing contaminant limits and suggested methods of analysis to assure that reclaimed refrigerant are acceptable for use in air-conditioning and refrigeration systems.” Ex. 1018, MXC-266–MXC-267.¹⁰ Under the ARI Standard 700, a refrigerant includes 10 ppm by

¹⁰ Our citations to Exhibits 1018, 1019, and 1020 refer to the pagination that Petitioner provided, and not to the original pagination of the documents.

weight water in the liquid phase, 1.5 vol% air in the vapor phase, 10 ppm max by weight acidity, 0.01 vol% high boiling point residue, no visual particulates or solids, and 0.5 wt% max “Other Refrigerants.” *Id.* at MXC-268.

The 2016 Standard “specifies acceptable levels of contaminants (purity requirements) for fluorocarbon, hydrocarbon, and carbon dioxide refrigerants regardless of source and lists acceptable test methods.” Ex. 1019, MXC-273. The 2016 Standard specifies that a test sample for a refrigerant “shall not contain more than 0.5% by weight of volatile impurities including other refrigerants.” *Id.* at MXC-274, MXC-277, MXC-279–295.

The 2017 Standard establishes various criteria for “Unitary Air-conditioners and Unitary Air-source Heat Pumps,” such as test requirements, rating requirements, operating requirements, and conformance conditions. Ex. 1020, MXC-306.

6. *Tung*

Tung is directed to “methods for preparing fluorinated organic compounds, and more particularly to methods of producing fluorinated olefins.” Ex. 1027, 1:33–35. Specifically, Tung discloses:

Applicants have discovered a method for producing fluorinated organic compounds, including hydrofluoropropenes, which preferably comprises converting at least one compound of Formula (I):



to at least one compound of Formula (II)



where each X, Y and Z is independently H, F, Cl, I or Br, and each m is independently 1, 2 or 3, and n is 0 or 1. As used herein and throughout, unless specifically indicated otherwise, the term

“converting” includes directly converting (for example, in a single reaction or under essentially one set of reaction conditions, an example of which is described hereinafter) and indirectly converting (for example, through two or more reactions or using more than a single set of reaction conditions).

Id. at 2:8–25.

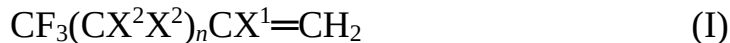
Tung discloses a specific embodiment using indirect conversion in which a monchlorotrifluoropropene according to formula IAA ($(C(X)_2=CClCF_3$, where X is H or Cl), preferably $CH_2=CF_3CCl$ (HFO-1233xf), is reacted “under conditions effective to produce at least one monchlorotetrafluoropropane in accordance with Formula (IB)” ($(C(X)_3CClYC(X)_3$, wherein each of X and Y is independently H, F, or Cl) and in turn exposing that product “to reaction conditions effective to produce at least one compound in accordance with Formula (II), preferably HFO-1234yf.” *Id.* at 2:31–36, 2:59–66, 3:29–39.

7. Mukhopadhyay

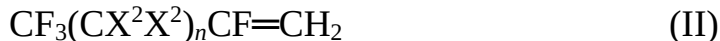
Mukhopadhyay is directed to “methods for preparing fluorinated organic compounds, and more particularly to methods of producing fluorinated olefins, and even more particularly to methods of preparing 2,3,3,3-tetrafluoro-1-propene (HFO-1234yf).” Ex. 1028, 1:33–37.

Specifically, Mukhopadhyay discloses:

Applicants have discovered a method for producing fluorinated organic compounds, including hydrofluoropropenes, which preferably comprises converting at least one compound of formula (I):



to at least one compound of formula (II)



where X^1 is Cl, Br or I, each X^2 is independently selected from the group consisting of H, Cl, F, Br or I, and n is 0, 1 or 2. In certain preferred embodiments, X^1 is Cl and n is 0.

Id. at 2:26–37. Mukhopadhyay further discloses examples that “illustrate gas fluorination in a first stage and a gas phase dehydrofluorination, using $CF_3CCl=CH_2$ to produce $CF_3CF=CH_2$ (1234yf).” *Id.* at 8:53–55.

D. Anticipation Grounds

Petitioner contends that claims 1–11 are anticipated by (1) Rao ’434, (2) Rao ’781, and (3) Rao ’597. Pet. 29–42. Petitioner contends that each of Rao ’434, Rao ’781, and Rao ’597 provides an example that is identical to one of the examples in the ’709 patent, and that each of the examples in Rao ’434, Rao ’781, and Rao ’597 yields identical results to those of the ’709 patent. *Id.* at 30 (Rao ’434 “provides one example, at column 4, lines 50–67 and at column 5, Table 1 (Ex. 1024), which is identical to example 2 and Table 3 of the ’709 patent shown at column 13, lines 29–57.”), 34 (Rao ’781 “discloses Example 1 at Column 6, (Ex. 1035) which is identical to Example 1 of the ’709 patent at its Column 13, (Ex. 1001), with the non-substantive exception that the titles are different.”), 38 (Rao ’597 “includes Example 3, at Column 7, lines 15–34, which is identical to Example 3 at Columns 13 (lines 60–67) through 14 (lines 1–16) of the ’709 patent. The results are identical. The examples only differ cosmetically.”). According to Petitioner, because “the examples of the ’709 patent are the basis for the support for the claims in the ’709 patent,” “the identical example in the prior art would anticipate the claims both directly and inherently.” *Id.* at 30; *see also id.* at 34 (“The identical example in the prior art would also be support for the claims, i.e., the example would anticipate the claims both directly and inherently.”), 39 (“The identical example in the

prior art would also be support for the claims, i.e., Example 3 of [Rao'597] anticipates the claims both directly and inherently.”).

Patent Owner responds that Petitioner’s argument “is based on a false premise that the only support for the claims of the ’709 patent are the working examples of the ’709 patent, which correspond to examples in” Rao ’434, Rao ’781, and Rao ’597. Prelim. Resp. 3. Patent Owner argues that Petitioner “fails to appreciate that the examples of [Rao ’434, Rao ’781, and Rao ’597] are designed to produce HFO-1234yf, are silent concerning 3,3,3-trifluoropropyne, and do not necessarily disclose the co-production of 3,3,3-trifluoropropyne.” *Id.*; *see also id.* at 24–25 (arguing that Petitioner lacks “evidence that the Examples of [Rao ’434] are the basis for the claims of the ’709 patent or that the claimed compositions *necessarily result* from the Examples”), 27 (arguing that Petitioner lacks “evidence that the Examples of [Rao ’781] are the basis for the claims of the ’709 patent”).

Based on the record before us, we are not persuaded that Petitioner sufficiently establishes that Rao ’434, Rao ’781, and Rao ’597 disclose compositions comprising HFO-1234yf, 3,3,3-trifluoropropyne, and at least one additional compound, as recited in independent claims 1, and 7 of the ’709 patent, or compositions comprising HFC-245eb, 3,3,3-trifluoropropyne, and at least one additional compound as recited in independent claim 11 of the ’709 patent. The ’709 patent states that the examples present a “general procedure [that] is illustrative of the method used for analyzing the products of fluorination reactions.” Ex. 1001, 12:30–33. Examples 1, 2, and 3 of the ’709 patent use that procedure to measure the reaction product of (1) vapor phase dehydrofluorination of HFC-245eb to HFO-1234 with fluoride alumina catalyst, (2) pyrolysis of HFC-245eb,

and (3) liquid phase dehydrofluorination of HFC-245eb to HFC-1234yf, respectively. *Id.* at 13:1–14:16. Although the '709 patent provides the amounts of a number of different reaction products detected in each example, i.e., HFO-1234yf, HFO-1234ze, and HFC-245eb, notably absent is a measurement for 3,3,3-trifluoropropyne. *Id.* There is no indication, therefore, that the products in the examples of the '709 patent represent the claimed compositions of the '709 patent, each of which requires the presence of 3,3,3-trifluoropropyne.

In that regard, Petitioner also argues that the '709 patent “discuss[es] that the process of Fig. 1, a process for making the claimed compositions, is supported by the examples.” Pet. 34 (citing Ex. 1001, 12:16–24). This appears to be no more than attorney argument, however, because the cited passage makes no mention of a relationship between Figure 1 and the examples:

Hydrogenation of the product of HFO-1234yf may produce HFC-245eb as an additional compound, as shown in FIG. 1, under the same conditions as described above for the hydrogenation of HFO-1234yf to HFC-245fb.

Dehydrofluorination of the HFC-245eb or HFC-254fb may produce HFO-1234zf as an additional compound, as shown in FIG. 1, under the same conditions as described herein for the dehydrofluorination of HFC-245eb to produce HFO-1234yf.

Ex. 1001, 12:16–24.

Petitioner's anticipation grounds rely solely on Petitioner's allegation that the examples in the '709 patent, and the corresponding examples in Rao '434, Rao '781, and Rao '597, disclose the claimed compositions. For the foregoing reasons, we find that Petitioner fails to demonstrate that any of Rao '434, Rao '781, and Rao '597 disclose, expressly or inherently,

compositions comprising HFO-1234yf, 3,3,3-trifluoropropyne, and at least one additional compound as recited in independent claims 1 and 7 of the '709 patent, or compositions comprising HFC-245eb, 3,3,3-trifluoropropyne, and at least one additional compound as recited in independent claim 11 of the '709 patent. Therefore, on this record, Petitioner has not established sufficiently that Rao '434, Rao '781, and Rao '597 each discloses every element of independent claims 1, 7, and 11, or dependent claims 2–6 (which depend from claim 1) and 8–10 (which depend from claim 7). Accordingly, we determine that Petitioner does not show a reasonable likelihood of prevailing on its assertion that Rao '434, Rao '781, and Rao '597 each anticipates claims 1–11 of the '709 patent.

E. Obviousness over Rao '434 and ARI Standards

Petitioner contends that claims 1–11 would have been obvious over the combined teachings of Rao '434 and the ARI Standards. Pet. 48–53. Petitioner relies on the Sandford Declaration in support of its contentions. *Id.* (citing Ex. 1005, *passim*). Petitioner contends that Rao '434 “discloses the identical example as is specifically disclosed in the '709 patent,” but “[n]either example recites the claim limitations in the '709 patent, namely greater than 99%” HFO-1234yf “and the presence of impurities, e.g., TFMA,^[11] less than 1%.” *Id.* at 48. Petitioner contends that a “POSITA, at the time of the invention, would necessarily have known that to sell 1234yf as a commercial refrigerant, that it must comply with regulatory standards” that “have been consistent for the last 30 years.” *Id.* (citing Ex. 1005 ¶ 45; Ex. 1018; Ex. 1019; Ex. 1020). According to Petitioner, a “POSITA would

¹¹ TFMA (trifluoromethyl (acetylene)) is another name for 3,3,3-trifluoropropyne. See Pet. vii.

understand that the resultant product stream” of the example in Rao ’434 “would be further purified to reach an acceptable, commercially viable” HFO-1234yf product. *Id.* at 49.

Petitioner further contends that it replicated the experiment set forth in Rao ’434, “with results similar to those in [Rao ‘’434] and the ’709 patent.” Pet. 49 (citing Ex. 1005, App. B). Petitioner notes that the method described in Rao ’434 “provided a low yield and poor selectivity,” but “there was enough crude material collected for further distillation for an enriched product stream” that was approximately 85% HFO-1234yf. *Id.* Petitioner further notes that “[t]he enriched product stream did not produce sufficient quantities to redistill to give [HFO]-1234yf in 99.5% purity in a laboratory setting.” *Id.* Instead, Petitioner explains that it “decided to prepare a synthetic blend representative of a fraction enriched in [HFO]-1234yf and to distil the synthetic mixture to illustrate the expected outcome of distilling a mixture of this composition and other [HFO]-1234yf enriched fractions.” *Id.* at 49–50. According to Petitioner, after distillation, the synthetic product mixture included 0.3% TFMA, 99.2% HFO-1234yf, and 0.6% other impurities,¹² which Petitioner asserts falls within the claims of the ’709 patent. *Id.* at 50.

Patent Owner argues, as it did with respect to Petitioner’s anticipation grounds, that “there is no basis for Petitioner’s assumption that the Example disclosed by [Rao ’434] would have necessarily resulted in the production of” TFMA. Prelim. Resp. 36 (citing Ex. 2003 ¶ 33). Patent Owner also argues that “Petitioner’s alleged replication of [Rao ’434’s] process

¹² We note that these reported amounts add up to 100.1%. Petitioner reports the sum as 100.0% in the Petition. *See* Pet. 50.

materially deviated from the process disclosed” therein, and “Petitioner’s distillation of its alleged replication of [Rao ’434’s] example is based on hindsight.” *Id.*

On this record, we are not persuaded that Petitioner has established that the combined teachings of Rao ’434 and the ARI Standards teach all of the limitations of the challenged claims. As an initial matter, for the reasons discussed above, we are not persuaded that the example in Rao ’434 on which Petitioner relies discloses, expressly or inherently, a composition that comprises HFO-1234yf or HFC-245eb, 3,3,3-trifluoropropyne, and at least one additional compound, as required by the challenged claims. *See supra* Section II.D. Thus, even if Petitioner is correct that a POSITA would understand that a composition made according to the example in Rao ’434 would be purified (in accordance with the ARI Standards) in order to be commercially viable, Petitioner has not established that the composition would contain 3,3,3-trifluoropropyne and the other components required by the challenged claims.

Petitioner’s replication of the example in Rao ’434 does not change this result. An experiment reproducing or recreating an example falls within the scope of that example so long as the reproduction is consistent with the teachings of the example, any deviations are immaterial, and the reasons for any deviations are adequately explained. *See, e.g., Purdue Pharma L.P. v. Epic Pharma, LLC*, 811 F.3d 1345, 1357 (Fed. Cir. 2016) (finding “no clear error” in the district court’s determination that the prior art application’s process was recreated “fairly, accurately, and with no material variation”); *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1047 n.4 (Fed. Cir. 1995) (finding no error in the district court’s determination that one skilled in the

art would have understood that testing departing from the “strict letter” of a prior art example was nonetheless consistent with that example). Based on the current record, we are not persuaded that Petitioner sufficiently establishes that its replication of Rao ’434’s example falls within the scope of the example.

In that regard, Petitioner acknowledges that Rao ’434’s example provided low yield and poor selectivity, and that the enriched product stream included only about 85% HFO-1234yf, which is well short of the at least 99% required by the challenged claims. *See* Pet. 49. Petitioner also was unable to redistill this enriched product stream in order to reach the required purity due to insufficient quantities of product, and instead prepared a synthetic blend it alleges is “representative” of the enriched product stream “to illustrate the expected outcome” of the distillation to 99.5% purity of HFO-1234yf. *Id.* at 49–50. Petitioner does not adequately explain, however, why the synthetic blend is representative of the product of Rao ’434’s example. For example, the synthetic blend included more HFO-1234yf and 3,3,3-trifluoropropyne than the enriched product stream. *Compare* Ex. 1005, App. B at MXC-118 (synthetic blend) *with id.* at MCX-117 (enriched product stream). Also, as Patent Owner’s declarant Dr. Thrasher notes, the synthetic blend contains “compounds not present or identified in the” enriched product stream, such as 143a, 1225zc, and 1243ze. Ex. 2003 ¶ 76. Neither Petitioner nor Dr. Sandford sufficiently explains why the differences between the synthetic blend and the enriched product stream would not have affected the composition of the final, distilled product that Petitioner contends falls within the scope of the challenged claims.

Moreover, Dr. Sandford identifies two deviations from the example of Rao '434 without adequately explaining why those deviations are immaterial. *See* Ex. 1005, App. B at MXC-114. First, Dr. Sandford states that capillary column GC and GCMS were used instead of Rao '434's packed column GCMS because it "is in general more sensitive and gives enhanced component resolution due to the small sample size, greater number of theoretical plates due to longer column length (30m) than packed columns (6.1m)." *Id.* Dr. Sandford further states that, because capillary columns are silica based, "HF was washed from the gaseous product mixture by passage through water before analysis" to avoid equipment damage. *Id.* This additional washing step is not included in Rao '434's example, but Dr. Sandford testifies that "analysis of the product mixture by capillary GC, following washing of the product, allowed the identification of all the components reported in [Rao '434], as ascertained by comparison with authentic commercial examples," and, "[t]hus, no differences in product profiles were observed." *Id.*

This explanation is insufficient to establish that this deviation is not material. Dr. Sandford does not explain adequately what effect, if any, washing HF from the gaseous product before analysis would have on the composition of the product. Dr. Sandford also does not describe the "authentic commercial samples" used to determine that the product profiles were not different when capillary column GC is used instead of packed column GC. In that regard, Dr. Sandford does not identify the source of the commercial samples, and does not report the components of the commercial samples and the amounts thereof. Moreover, we are not directed to any objective evidence in the record that establishes that the commercial samples

were made according to Rao '434's example, or that supports Dr. Sandford's testimony that "no differences in product profiles were observed."

Therefore, on this record, we are not persuaded that the use of capillary column GC is a non-material deviation from the process set forth in Rao '434's example.

Second, Dr. Sandford states that "[a] convection oven heater was used rather than a band heater," and that, because "both systems heat metal reactor tubes to 750°C no difference in reaction product profile can be expected." Ex. 1005, App. B at MXC-114. Neither Petitioner nor Dr. Sandford, however, adequately explains the reason for this deviation from Rao '434's example. Although Dr. Sandford testifies that differences in reaction profiles are not expected when using a convection oven heater instead of a band heater, we are not directed to any objective evidence to support this conclusion. *Id.* Also missing from the record is an explanation of why a convection oven heater was even used instead of a band heater as described in Rao '434's example. Dr. Sandford's conclusory testimony that a POSITA "would not see these deviations as material" is not enough to establish that the described deviations are immaterial to the results of the reproduction of Rao '434's example. *See* Ex. 1005 ¶ 60.

Petitioner "has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); *see also SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018) ("in an inter partes review, the petitioner is master of its complaint"). Based on our review of the record, we find that there is insufficient explanation supported by record evidence that Petitioner's reproduction of Rao '434's example falls within the scope of the

example, and, therefore, Petitioner does not establish a reasonable likelihood that Rao '434 discloses the claimed composition, namely, HFO-1234yf, 3,3,3-trifluoropropyne, and one additional component.

For these reasons, we determine that Petitioner has not established sufficiently that the combined teachings of Rao '434 and the ARI Standards discloses or suggests all of the limitations of the challenged claims, and we determine that Petitioner does not show a reasonable likelihood of prevailing on its assertion that the subject matter of claims 1–11 of the '709 patent would have been obvious over the combined teachings of Rao '434 and the ARI Standards.

F. Remaining Grounds

Petitioner contends that (1) claims 1–11 would have been obvious over the combined teachings of Rao '781 and the ARI Standards, and the combined teachings of Rao '597 and the ARI Standards (Pet. 53–62); (2) claims 1–4 would have been obvious over the combined teachings of Nose and the ARI Standards (*id.* at 43–47); and (3) claim 1 would have been obvious over the combined teachings of Tung and the ARI Standards, and Mukhopadhyay and the ARI Standards (*id.* at 62–67). “Office guidance issued on June 5, 2018 explains that the Board may consider the number of claims and grounds that meet the reasonable likelihood standard when deciding whether to institute an *inter partes* review under 35 U.S.C. § 314(a).” *Chevron Oronite Co. LLC v. Infineum USA L.P.*, Case IPR2018-00923, slip op. at 10–11 (PTAB Nov. 7, 2018), Paper 9 (citing SAS Q&As, part D, Effect of SAS on future challenges that could be denied for statutory reasons (June 5, 2018)) (informative). Here, Petitioner challenges claims 1–11 under six asserted grounds of unpatentability, and does not demonstrate a

reasonable likelihood of prevailing with respect to four of those asserted grounds. We conclude that the burden of addressing the four grounds that we determine have no reasonable likelihood of success overwhelms the benefits of resolving the remaining two grounds that challenge claims 1–11, and the three grounds that address less than all of the challenged claims, even if Petitioner were to establish a reasonable likelihood of prevailing as to those challenges. *See SAS Q&As*, part D, Effect of SAS on future challenges that could be denied for statutory reasons (June 5, 2018) (“[T]he panel will evaluate the challenges and determine whether, in the interests of efficient administration of the Office and integrity of the patent system (*see* 35 USC § 316 (B)), the entire petition should be denied under 35 USC § 314(a).”). Accordingly, we exercise our discretion and do not institute an *inter partes* review on the grounds that (1) claims 1–11 would have been obvious over the combined teachings of Rao ’781 and the ARI Standards, and the combined teachings of Rao ’597 and the ARI Standards, (2) claims 1–4 would have been obvious over the combined teachings of Nose and the ARI Standards, and (3) claim 1 would have been obvious over the combined teachings of Tung and the ARI Standards, and Mukhopadhyay and the ARI Standards.

III. CONCLUSION

Based on the arguments in the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner has not established a reasonable likelihood that it would prevail on its challenge that claims 1–11 of the ’709 patent are unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby
ORDERED that the Petition is *denied*.

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