

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TRYDEL RESEARCH PTY LTD.,
Petitioner,

v.

ITW GLOBAL TIRE REPAIR INC.,
Patent Owner.

IPR2019-01202
Patent 7,388,041 B2

Before CHRISTOPHER L. CRUMBLEY, KRISTINA M. KALAN, and
CHRISTOPHER M. KAISER, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Trydel Research Pty Ltd. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting *inter partes* review of claims 1–5, 9, 17, 20, 26, 27, 29, 30, and 32 of U.S. Patent No. 7,388,041 B2 (Ex. 1001, “the ’041 patent”). ITW Global Tire Repair Inc. (“Patent Owner”)¹ filed a Preliminary Response to the Petition (Paper 9, “Prelim. Resp.”). We instituted an *inter partes* review of claims 1–5, 9, 17, 20, 26, 27, 29, 30, and 32 of the ’041 patent on all grounds of unpatentability alleged in the Petition. Paper 10 (“Institution Decision” or “Dec.”).

After institution of trial, Patent Owner filed a Patent Owner Response. Paper 17 (“PO Resp.”). Subsequently, Petitioner filed a Reply. Paper 19 (“Reply”). An oral hearing was held on September 17, 2020, and a transcript of the hearing is included in the record. Paper 25 (“Tr.”).

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has established by a preponderance of the evidence that claims 1–4, 9, 17, and 20 of the ’041 patent are unpatentable, but has not established by a preponderance of the evidence that claims 5, 26, 27, 29, 30, and 32 are unpatentable.

A. *Related Proceedings*

The parties do not identify any related matters. Pet. 3; Paper 4, 2.

¹ Patent Owner, in certain papers, alternately referred to itself as Illinois Tool Works Inc. (*see, e.g.*, Paper 4, 2; Paper 5, 2) and ITW Global Tire Repair Inc. (*see, e.g.*, Prelim. Resp. 1). Following a request for clarification (Dec. 2 n. 1), Patent Owner indicated that ITW Global Tire Repair Inc. is a wholly-owned subsidiary of Illinois Tool Works Inc., the originally-named Patent Owner in this proceeding (Paper 13, 2).

B. The '041 Patent

The '041 patent, titled “Puncture Sealing Agent for a Tire, and Process for Producing the Same,” is directed to a puncture sealing agent for a tire that has a rubber latex, an adhesive agent, and an anti-freezing agent. Ex. 1001, code (54), (57). The '041 patent explains that known puncture sealing agents contain a rubber latex blended with ethylene glycol or propylene glycol as an anti-freezing agent. *Id.* at 1:21–24. According to the '041 patent, the interaction of the rubber particles and adhesive agent particles with the aqueous ethylene glycol solution transforms the puncture sealing agent into a “creamy material.” *Id.* at 1:24–44. During long-term storage of known puncture sealing agents, the creamy material “clogs the outlet of a tire sealant container,” thereby “hindering the passage of the sealing agent out of the containe[r] into the tire so that smooth puncture sealing operation cannot be carried out.” *Id.* at 1:28–32.

To address the clogging problem, the '041 patent discloses using glycerin as a higher density anti-freezing agent and adding a surfactant to suppress the formation of a particle-concentrated layer near the surface. *Id.* at 1:51–58. The '041 patent states that the resulting puncture sealing agent has longer-term stability than typical agents. *Id.* at 1:58–61.

The '041 patent discloses that the rubber latex may be natural rubber or synthetic rubber. *Id.* at 3:14–16. The rubber latex may also be a combination of natural rubber and synthetic rubber, and the synthetic rubber may be styrene-butadiene rubber. *Id.* at 3:35–40.

The puncture sealing agent may include an adhesive agent that does not cause aggregation of the rubber latex. *Id.* at 3:50–53. Preferred examples of the adhesive include polyvinyl esters, polyvinyl alcohol, and

polyvinyl pyrrolidine. *Id.* at 3:54–56. “The ratio of the adhesive agent to the total weight of the puncture sealing agent is preferably between 5 and 30% by weight.” *Id.* at 3:59–61.

The puncture sealing agent may also include a surfactant, fibers or a fibrous compound, an antioxidant agent, and/or a corrosion inhibitor agent. *Id.* at 3:1–4, 8:14–38, Table 2. The surfactant “may be an anionic surfactant, an ampholytic surfactant, a special carboxylic acid type surfactant or the like.” *Id.* at 4:65–5:1. Preferred surfactants include ammonium laurate and triethanolamine laurate. *Id.* at 5:14–24. The fibers or fibrous material that improve the puncture sealing properties of the puncture sealing agent may preferably be between 1 and 150 microns in size. *Id.* at 4:3–7.

The puncture sealing agent may also include a thickening agent and rubber chunks. *Id.* at 8:39–46; 9:26–45, Table 3. The thickening agent may be in the form of clays, cellulose thickeners, or natural gums. *Id.* at 9:16–21.

C. Illustrative Claims

Petitioner challenges claims 1–5, 9, 17, 20, 26, 27, 29, 30, and 32 of the ’041 patent. Claims 1 and 26 are reproduced below:

1. A puncture sealing agent, comprising:
a rubber latex comprising one of a natural rubber and a synthetic rubber mixed with a glycerin² anti-freezing agent wherein a ratio of the glycerin anti-freezing agent to the total weight of the puncture sealing agent composition is between 5 and 75% by weight.

Ex. 1001, 9:55–60.

² Petitioner contends that glycerin, glycerine, and glycerol refer to the same compound, i.e., propane-1,2,3-triol. Pet. 2 (citing Ex. 1011 ¶ 56 n.1). Patent Owner does not appear to dispute this contention.

26. A puncture sealing agent comprising:
one or more fibers, a thickening agent and a glycerin
anti-freezing agent mixed together and further
comprising one of a rubber latex, an adhesive agent
and one or more rubber chunks mixed into the
agent; and
wherein the ratio of the glycerin to the total weight of
the puncture sealing agent is 5 to 70% by weight.

Ex. 1001, 11:26–32.

D. Instituted Grounds of Unpatentability

We instituted *inter partes* review of claims 1–5, 9, 17, 20, 26, 27, 29, 30, and 32 of the '041 patent on the following grounds.

Reference(s)/Basis	35 U.S.C. § ³	Claims
Haifeng ⁴	102(b)	1–4, 9, 17, 20
Haifeng, Boxi ⁵	103(a)	1–4, 9, 17, 20
Haifeng, Kishida, ⁶ Guihe ⁷	103(a)	1–5, ⁸ 9, 17, 20
Boxi, Kishida	103(a)	1–4, 9, 17, 20

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the '041 patent issued was filed before this date, the pre-AIA version of § 103 applies.

⁴ CN 1062363 A, issued July 1, 1992 (Ex. 1002).

⁵ CN 1076954 A, issued October 6, 1993 (Ex. 1003).

⁶ US 2003/0050365 A1, published March 13, 2003 (Ex. 1004).

⁷ CN 1737073 A, published February 22, 2006 (Ex. 1007).

⁸ The summary of the grounds on page 4 of the Petition lists claims 1–4, whereas the arguments starting on page 33 of the Petition identify claims 1–5. Pet. 4, 30, 33. Because Petitioner provided arguments for claim 5, we consider claim 5 to be part of this ground.

Reference(s)/Basis	35 U.S.C. § ³	Claims
Haifeng, Wong, ⁹ Jaksa ¹⁰	103(a)	26, 27, 29, 30, 32
Boxi, Wong, Jaksa	103(a)	26, 29, 30, 32

Petitioner relies on the Declarations of Dr. Joseph Incavo. Ex. 1011; Ex. 1024. Patent Owner relies on the Declaration of Dr. Charles Daniels. Ex. 2010.

II. ANALYSIS

A. Legal Standards

To anticipate a patent claim under 35 U.S.C. § 102, a single prior art reference must “describe every element of the claimed invention, either expressly or inherently,” to one of ordinary skill in the art. *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000). “[A] reference can anticipate a claim even if it does not expressly spell out all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would at once envisage the claimed arrangement or combination.” *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015) (internal quotations omitted). “When the claimed compositions are not novel they are not rendered patentable by recitation of properties, whether or not these properties are shown or suggested in the prior art.” *In re Spada*, 911 F.2d 705, 709 (Fed. Cir. 1990).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such

⁹ US 5,856,376, issued January 5, 1999 (Ex. 1005).

¹⁰ US 5,908,145, issued June 1, 1999 (Ex. 1009).

that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Secondary considerations may include the following: “commercial success, long felt but unsolved needs, failure of others, etc.”¹¹ *Id.* The totality of the evidence submitted may show that the challenged claims would not have been obvious to one of ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984).

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378–1379 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). 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

¹¹ Patent Owner did not present any evidence or arguments directed to secondary considerations during this proceeding.

reasonable expectation of success in doing so.” *Procter & Gamble Co. v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009) (quoting *Pfizer, Inc. v. Apotex, Inc.*, 408 F.3d 1348, 1361 (Fed. Cir. 2007)).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art to which the '041 patent pertains would have

either: (1) a Ph.D. in the field of chemistry, chemical engineering and/or a related field, and having at least one year of educational or work experience in the development of tire sealants; (2) a bachelor's degree in the field of chemistry, chemical engineering, and or related field, and at least two years of work experience in the development of tire sealants; or (3) any education and experience equivalent to (1) or (2). (Ex. 1011, ¶26).

Pet. 5.

Patent Owner does not challenge Petitioner's definition of the level of ordinary skill in the art. Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art. On this record, we adopt Petitioner's formulation regarding the level of ordinary skill in the art. The level of ordinary skill in the art is also reflected by the references themselves. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (“[T]he absence of specific findings on the level of skill in the art does not give rise to reversible error ‘where the prior art itself reflects an appropriate level and a need for testimony is not shown.’”); *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).

C. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board*, 83 Fed. Reg. 51,340, 51,358 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). 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 terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner proposes construing the term “rubber chunks” to mean “solid [] pieces of rubber.” Pet. 13 (citing Ex. 1011 ¶ 84). Patent Owner does not present a proposed construction. We find that, on this complete record, this term does not need express construction.

Patent Owner proposes construing the terms “rubber latex,” “natural rubber,” and “synthetic rubber” as follows:

“ <i>rubber latex</i> ” is a stable dispersion (i.e., emulsion) of rubber particles in water
“ <i>natural rubber</i> ” is a naturally-occurring elastic substance that is essentially a polymer of isoprene
“ <i>synthetic rubber</i> ” is any of various synthetic rubberlike substances

PO Resp. 5.

Petitioner states it does “not dispute Patent Owner’s proposed construction of ‘rubber latex,’ ‘natural rubber,’ and ‘synthetic rubber.’” Reply 2; *see also* Tr. 13:22–27. Petitioner, however, takes issue with Patent Owner’s proposed construction of “latex,” stating that “there is no need to construe ‘latex’” because the term, “by itself, does not appear in any of the claims of the ‘041 patent.” Reply 2. Rather, Petitioner argues, skilled artisans in the tire sealant industry would “use the terms ‘latex’ and ‘rubber latex’ interchangeably,” as does the ‘041 patent and the prior art. *Id.* at 2–3 (citing Ex. 1024 ¶¶ 8–9, 33–39, 66–67); *see also* Tr. 10:21–25.

Based on the lack of dispute between the parties and our own understanding of the claim terms “rubber latex,” “natural rubber,” and “synthetic rubber,” we adopt Patent Owner’s proposed construction of these terms, namely:

“ <i>rubber latex</i> ” is a stable dispersion (i.e., emulsion) of rubber particles in water
“ <i>natural rubber</i> ” is a naturally-occurring elastic substance that is essentially a polymer of isoprene
“ <i>synthetic rubber</i> ” is any of various synthetic rubberlike substances

We agree that we need not construe the term “latex.”

Patent Owner also proposes construing the terms “additional sealing capability” and “enhance sealing capability” as follows:

“ <i>additional sealing capability</i> ” means <u>additional</u> capability to block air from escaping a puncture hole

“*enhance sealing capability*” means the sealant’s capability to block air from escaping a puncture hole is enhanced

PO Resp. 13.

Petitioner replies that these terms are self-explanatory and do not need construction. Reply 3–4. If the terms do need construction, Petitioner proposes that “an adhesive agent for additional sealing capability” be construed to mean “an adhesive that improves the sealing ability of the puncture sealing agent” (citing Ex. 1001, 2:56–59), and that “one of fibers and fibrous materials that enhance sealing capability of a puncture sealing agent” be construed to mean “fibers or fibrous materials that improve the puncture sealing properties of the puncture sealing agent” (citing Ex. 1001, 4:3–6; Ex. 1025, 71:8–72:1). Reply 3–4.

We agree with Petitioner that these terms are self-explanatory and do not need express construction. To the extent necessary, we discuss these terms according to their plain and ordinary meaning in the analysis below.

We determine it is not necessary to construe any other claim term expressly to resolve the parties’ dispute. *Vivid Techs., Inc.*, 200 F.3d at 803 (“only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

D. Relied-Upon References

i. Haifeng (Ex. 1002)

Haifeng, titled “Special-effect Automatic Tire Sealant,” discloses a tire sealant that automatically repairs tires, prepared by mixing an adhesive with “additives such as reinforcing agent, stabilizer, antifreeze, antioxidant,

and corrosion inhibitor.” Ex. 1002, code (54), 3. The adhesive may include a natural high-molecular compound or synthetic resin, and accounts for 20–65% of the total weight of the tire sealant. *Id.* Haifeng discloses that the “ratio of the tire sealant can be adjusted according to the requirements of different regions and different vehicles.” *Id.* at code (57).

Haifeng discloses that the reinforcing agent may include asbestos, bentonite, and natural and synthetic fibers. *Id.* at 3. The antifreeze may be glycerin, ethylene glycol, or 1,2-propylene glycol. *Id.* at 4. The corrosion inhibitor may include nitrites. *Id.* The stabilizer may include “polyvinyl alcohol, a leveling agent O, sodium petroleum sulfonate, sodium rosinate, an emulsifier OP, sodium dodecylbenzenesulfonate or the like.” *Id.*

Haifeng discloses “Embodiment 1,” wherein the “raw materials were weighed according to the following ratio (weight)”:

Styrene-butadiene latex	100
Polyvinyl alcohol	6
Glycerin	10
Sodium nitrate	0.2

Id. Regarding Embodiment 1, Haifeng discloses the “styrene-butadiene latex was placed in a mixing kettle with a stirrer, the polyvinyl alcohol and the sodium nitrite were gradually added under constant stirring, the glycerin was finally added, and the mixture was uniformly stirred, and bottled to obtain the finished product.” *Id.*

ii. *Boxi (Ex. 1003)*

Boxi, titled “Strong Antifreeze Sealant for Tire” is directed to a “sealant which can maintain a good sealing effect at a low temperature.” Ex. 1003, code (54), 3. Boxi discloses “a combination of a binder, filler, an

antifreeze, an antioxidant, a preservative and water that are compatible with each other.” *Id.*

Boxi discloses the binder “comprises cellulose derivatives, polyvinylpyrrolidone, latex, 107 glue, polyacrylamide, polyacrylic acid or the like.” *Id.* Boxi discloses the filler may include fibrous filler, e.g., “cotton fibers, asbestos fibers, wool, synthetic fibers, hair, velvet and the like.” *Id.* In a specific embodiment, Boxi discloses a method wherein “carboxymethyl cellulose was dissolved in water, the concentration being 3%–15%,” a latex (concentration being 3%–15%) was added; “cement antifreeze ash (concentration 1–12%), cotton fibers (1–10%), gypsum powder (0.5–8%), glycerol (5–40%) and isobutanol (5–40%) were continuously added; and the mixture was stirred sufficiently and uniformly, and packaged for later use.” *Id.*

iii. *Kishida (Ex. 1004)*

Kishida, titled “Puncture Sealing Agent for a Tire, and Process for Producing the Same,” is directed to “a puncture sealing agent for a tire, comprising a rubber latex, an adhesive agent and an antifreezing agent, wherein propylene glycol is used as the antifreezing agent.” Ex. 1004, code (54), ¶ 21. Kishida states that ethylene glycol is generally adopted as an antifreezing agent, but that Kishida’s preferred examples use propylene glycol. *Id.* ¶¶ 5, 21. Kishida discloses that the “use of propylene glycol as an antifreezing agent causes suppression of the phenomenon that rubber particles are concentrated nearby the surface and transformed to a creamy material when the agent is stored for a long term, so as changing to long-term storability.” *Id.* ¶ 10.

Kishida discloses that the rubber latex is preferably a natural rubber latex having a high sealing ability. *Id.* ¶ 22. Kishida discloses one part of the natural rubber latex may be replaced with a synthetic rubber latex such as styrene-butadiene rubber. *Id.* ¶ 23. Kishida discloses the adhesive agent may include various resin adhesive agents “used in order to heighten adhesion between the rubber latex and a tire to improve sealing ability, and the ratio thereof to the total weight of the puncture sealing agent is preferably from 10 to 30% by weight.” *Id.* ¶ 26.

Kishida discloses that a “surfactant may be added, as a stabilizer, to the puncture sealing agent. As this surfactant, an anionic surfactant, an ampholytic surfactant, a special carboxylic acid type surfactant, or the like may be used.” *Id.* ¶ 35. Kishida discloses that the “ratio of the surfactant to the total weight of the puncture sealing agent is from 0.4 to 2.0% by weight,” and if the ratio is less, “the stability of the puncture sealing agent becomes insufficient,” and “the effect of suppressing the generation of the creamy material is damaged.” *Id.* ¶ 39.

Kishida further discloses a process for producing the puncture sealing agent. *Id.* ¶ 14. The process includes the steps of “pouring/mixing the adhesive agent into/with the rubber latex under stirring to prepare an adhesive agent poured/mixed solution.” *Id.* ¶ 15. The process further includes the step of “pouring/mixing an aqueous propylene glycol solution wherein the propylene glycol is diluted with water into/with the adhesive agent poured/mixed solution under stirring.” *Id.* ¶ 16.

iv. *Guihe (Ex. 1007)*

Guihe, titled “Auto Tire Repair Glue,” discloses a tire repair glue including a natural rubber latex, microfiber, glycerol,¹² ethylene glycol, stabilizer, and water. Ex. 1007, code (54), 3. Guihe discloses that microfibers “can produce a mixed polymer stopper to increase the strength of the stopper and the service life in a tire when the tire repair glue rubs a puncture, and the added amount is 1% to 5%. The length of microfibers is 0.05 mm to 2.0 mm.” *Id.* at 4.

v. *Wong (Ex. 1005)*

Wong, titled “Tire Puncture Sealant,” is directed to “a particulate, surface-activated, polymeric component” dispersed in a fluid medium, further comprising “water, a freeze preventative, and typical additives such as an alkali metal carbonate, a corrosion inhibitor, a thickener, an oxidizer and a latex, preferably an SBR (styrene butadiene rubber) latex, to promote dispersion throughout the sealant composition.” Ex. 1005, code (54), 2:33–40. Wong discloses the amount of SBR latex may be about 3% by weight. *Id.* at code (57), 4:36–43.

Wong discloses the powdered polymeric material is “selected from the group consisting of crushed and ground, recycled post-consumer tire material tire rubber, ultra high molecular weight polyethylene, and mixtures thereof.” *Id.* at 2:17–20. Wong discloses that the freeze preventative component “is preferably an alkyl polyol such as, for example, ethylene glycol, propylene glycol or glycerine, that will suppress the freezing point of

¹² As noted earlier, Petitioner contends that glycerin, glycerine, and glycerol all refer to the same compound, i.e., propane-1,2,3-triol. Pet. 2 (citing Ex. 1011 ¶ 56 n.1).

the tire sealant composition to the lowest temperature level typically encountered during shipping, storage and normal service.” *Id.* at 4:28–35. Wong discloses the thickener may include a cellulosic thickener or a polysaccharide xanthan gum. *Id.* at code (57), 4:51–52.

vi. Jaksa (Ex. 1009)

Jaksa is a patent titled “Pneumatic Tire Sealant Dispenser.” Ex. 1009, code (54). Jaksa discloses known pneumatic tire sealants that “are viscous fluids, with chunks of raw rubber injected through the tire valve to seal punctures generally up to ¼ in. diameter.” *Id.* at 1:10–15.

E. Analysis

i. Asserted Anticipation by Haifeng (Ground 1)

Petitioner contends that claims 1–4, 9, 17, and 20 are anticipated by Haifeng under 35 U.S.C. § 102(b). Pet. 13–19.

a. Claim 1

For claim 1, Petitioner asserts that Haifeng discloses a puncture sealant agent, because Haifeng’s composition is a tire sealant that automatically repairs tires. Pet. 14 (citing Ex. 1002, 3).

Petitioner asserts that Haifeng discloses claim 1’s “rubber latex comprising one of a natural rubber and a synthetic rubber,” because Haifeng’s adhesive contains natural or synthetic rubbers. *Id.* (citing Ex. 1002, 3 (“The natural high-molecular compounds include . . . natural rubbers . . . [and] synthetic resins include . . . synthetic rubbers (butadiene-styrene . . .)”)).

Petitioner contends that Haifeng discloses claim 1’s glycerin anti-freezing agent, because Haifeng’s formulation contains glycerin. *Id.* (citing Ex. 1002, 4). Petitioner contends that Haifeng discloses claim 1’s ratio of

glycerin to the total weight of puncture sealing agent composition of between 5 and 75% by weight, because Haifeng's Embodiment 1 has 10 parts glycerin per 116.2 total parts composition, which corresponds to 8.6% glycerin. *Id.* at 14–15 (citing Ex. 1002, 4; Ex. 1011 ¶ 88).

Patent Owner contends Petitioner fails to prove that Haifeng discloses a rubber latex. PO Resp. 16. Patent Owner contends that “rubber latex” is “something very specific—a stable dispersion (i.e., emulsion) of rubber particles in water,” and that a “formulation that contains ‘rubber’ does not necessarily contain a ‘rubber latex.’” *Id.* According to Patent Owner, Petitioner also has not shown that Haifeng's “styrene-butadiene latex” in Embodiment 1 is a “rubber latex” as in claim 1. *Id.* at 19. Sometimes, according to Patent Owner, the term “styrene-butadiene latex” may simply refer to “styrene butadiene latex” and not “styrene-butadiene rubber latex.” *Id.* (citing Ex. 2011, 81:23–82:25 (Dr. Incavo testimony)).

As additional support for its position that Haifeng discloses “rubber latex,” Petitioner replies that Haifeng's Embodiment 2 discloses the use of “natural latex,” and that the “natural latex” of Embodiment 2 is “natural rubber.” Reply 5 (citing Ex. 1002, 3, 4; Ex. 1024 ¶ 19). Petitioner also replies that Haifeng's Embodiment 1 discloses “synthetic rubber latex” in the form of “styrene-butadiene latex.” *Id.* at 6. Petitioner relies on Dr. Incavo's reply testimony to demonstrate that “non-rubber” latexes are “hard, stiff, and brittle, and have no viscoelastic character or strength” and “are ill-suited as the main ingredient to tire sealants.” *Id.* at 8–9 (citing Ex. 1024 ¶¶ 28–31).

Patent Owner responds that Petitioner was required to show in the Petition that Haifeng disclosed “rubber latex,” but failed to do so. Sur-

Reply 6. First, Patent Owner argues, Petitioner points to a previously-uncited embodiment in Haifeng—Embodiment 2—containing “natural latex.” *Id.* at 7. Second, Patent Owner argues, Petitioner offers a new argument regarding Haifeng’s Embodiment 1, namely, that Haifeng’s disclosure of “styrene butadiene latex” really meant “styrene butadiene rubber latex.” *Id.* at 7–8. Third, Patent Owner argues that Petitioner offers another new argument that Haifeng’s “styrene butadiene latex” must have been referring to “styrene butadiene rubber latex,” based on Dr. Incavo’s reply testimony and testing. *Id.* at 8.

Claim 1 requires “a rubber latex comprising one of a natural rubber and a synthetic rubber.” Ex. 1001, 9:56–57. As discussed in our claim construction, the parties agree that “rubber latex” is “a stable dispersion (i.e. emulsion) of rubber particles in water.” *See supra* 9–10; *see also* PO Resp. 5. Furthermore, the parties agree that “natural rubber” is “a naturally-occurring elastic substance that is essentially a polymer of isoprene” and that “synthetic rubber” is “any of various synthetic rubberlike substances.” *Id.*

Haifeng discloses that its adhesive may contain a “natural high-molecular compound or synthetic resin as a main agent.” Ex. 1002, 3. Haifeng further discloses that its “natural high-molecular compounds” may include “natural rubbers.” *Id.* Haifeng also discloses that its “synthetic resins” may include “synthetic rubbers” such as “butadiene-styrene.” *Id.* This explanation clearly indicates that “natural rubbers” and “synthetic rubbers” are examples of the “main agent” of Haifeng’s adhesive. Next, in Embodiment 1, Haifeng discloses that the main agent is “styrene-butadiene latex.” *Id.* at 4. In Embodiment 2, Haifeng discloses that the main agent is “natural latex.” *Id.* We look to Embodiments 1 and 2 as examples of

Haifeng's use of its terminology, and do not consider Petitioner's arguments on these points to be improperly new. Even though Petitioner did not expressly rely on Embodiment 1 to disclose the "rubber latex" element of claim 1 (Pet. 14), Petitioner did rely on Embodiment 1, which includes styrene-butadiene latex, to teach claim 1's ratio of glycerin to total weight. *Id.* at 14–15. Embodiment 2's use of "natural latex" sheds additional light on Haifeng's internal use of terminology relating to "natural rubber" and "natural latex."

Although Haifeng's discussion of "natural rubbers" and "synthetic rubbers" does not expressly include the word latex (Ex. 1002, 3), Haifeng's Embodiments do expressly use the word "latex." Haifeng's Embodiment 1 lists "styrene-butadiene latex" as the main agent by weight. *Id.* at 4. Haifeng's Embodiment 2 lists "natural latex" as the main agent by weight. The Embodiments do not expressly use the word "rubber"—i.e., the Embodiments do not expressly state "styrene-butadiene rubber latex" and "natural rubber latex." Given Haifeng's explanation and the explanations of the declarants, however, this is the most plausible interpretation of the reference's disclosure. Haifeng discloses that "styrene-butadiene" is one of its possible "synthetic rubber" main agents, and then uses styrene-butadiene rubber as the main agent in Embodiment 1 in its "styrene-butadiene latex" form. *Id.* at 3–4. Similarly, Haifeng discloses that "natural rubber" is one of its "natural high-molecular compound" main agents, and then uses natural rubber as the main agent in Embodiment 2 in its "natural latex" form. *Id.*; Ex. 1024 ¶ 19. Thus, Haifeng's shorthand of using the term "styrene-butadiene latex" instead of "styrene-butadiene rubber latex" in its Embodiment 1 does not undermine our finding that a person of skill in the

art would understand Haifeng to disclose using styrene-butadiene rubber latex, based on the reading of Haifeng as a whole, including particularly: the specification and Embodiments (Ex. 1002, 3–4); the industry’s synonymous use of terms (Tr. 9:21–10:1, 10:21–11:7, 22:7–20); and the testimony supporting this interpretation (Ex. 1024 ¶¶ 9, 19).

Thus, on this complete record, we find that Haifeng describes the subject matter of claim 1.

b. Claim 2

For claim 2, which requires “an adhesive agent for additional sealing capability wherein a ratio of the adhesive agent to the total weight of the puncture sealing agent composition is between 5% and 30% by weight,” Petitioner asserts Haifeng discloses an adhesive agent for additional sealing capability, because Haifeng’s composition contains polyvinyl alcohol (“PVA”), “which is identified in the ’041 patent as an adhesive agent.” Pet. 15–16 (citing Ex. 1002, 4; Ex. 1001, 3:54–56). Petitioner contends Haifeng discloses that the ratio of the adhesive agent to the total weight of the puncture sealing agent composition is between 5% and 30% by weight, because Haifeng’s Embodiment 1 contains 6 parts polyvinyl alcohol adhesive per 116.2 total parts, corresponding to 5.1% adhesive. *Id.* (citing Ex. 1002, 4; Ex. 1011 ¶ 89).

Patent Owner contends Petitioner fails to prove that Haifeng discloses an “adhesive agent for additional sealing capability.” PO Resp. 20 (emphasis omitted). Patent Owner contends that Haifeng’s polyvinyl alcohol, which Petitioner relies on to disclose the “adhesive agent,” does not provide any additional sealing capability as required by claim 2. *Id.* at 21–22 (citing Ex. 2011, 88:12–90:2) (Petitioner’s expert’s statement regarding

this limitation). Patent Owner also contends Petitioner has not shown that PVA acts as an adhesive at an amount of 5.1%. *Id.* at 22–24.

Petitioner replies that Haifeng’s PVA “is a known adhesive agent used to improve the sealing properties of tire sealants.” Reply 9 (citing Ex. 1024 ¶¶ 40–46). Although Patent Owner and its expert “speculate that Haifeng’s use of 5.1% by weight of PVA ‘would not necessarily . . . add any additional sealing capability,’” Petitioner argues that this speculation “is at odds with the specification of the ‘041 patent” and “Patent Owner’s other patent documents.” *Id.* at 10 (citing Ex. 2010 ¶ 72; Ex. 1001, 3:54–61; Ex. 1041 ¶ 15; Ex. 1042, 3:25–30). Finally, Petitioner denies the alleged necessity of testing to show the relative effect that any adhesive in Haifeng has on sealing capability, because those of ordinary skill in the art would know PVA’s role in tire sealants. *Id.* Petitioner also argued that whether PVA is “serving as an adhesive agent or a stabilizer, it’s still improving the sealing capability of the puncture sealing agent.” Tr. 27:6–8.

Patent Owner replies that Petitioner improperly raises the “additional sealing capability” argument for the first time on reply. Sur-Reply 10. Patent Owner further replies that the ’041 patent does not say that the 5.1% of PVA disclosed in Haifeng would provide “additional sealing capability.” *Id.* at 11.

Although Haifeng discloses that polyvinyl alcohol may be a stabilizer (Ex. 1002, 4), Haifeng also identifies polyvinyl alcohol as an adhesive. More particularly, Haifeng includes polyvinyl alcohol in its list of vinyl resins (*id.* at 3), which are a type of resin included in the list of Haifeng’s synthetic resins, which are, in turn, identified as an adhesive used in the invention of Haifeng. *Id.* (“The adhesive used in the present invention is

prepared by mixing a natural high-molecular compound or synthetic resin as a main agent” and can include “modifications and mixtures of the various above adhesives.”). Haifeng’s Embodiment 1 includes styrene-butadiene latex and polyvinyl alcohol, which can be “adhesives” according to Haifeng. *Id.* at 4.

From a purely lexicographical standpoint, it seems axiomatic that a known adhesive (PVA) that is also identified by Haifeng as an adhesive (Ex. 1002, 3) would provide additional sealing capability. Not only does Haifeng itself define PVA as an adhesive, but testimony confirms that PVA is a well-known adhesive: an “adhesive agent is there for the express purpose of improving the adhesion between the latex and the tire, which, as a result, improves the ability of the sealing agent overall to work.” Ex. 1025, 74:1–5, 54:13–55:15; Ex. 1024 ¶¶ 40–46. This is consistent with the Patent Owner’s proposed claim construction that “additional sealing capability” means additional capability to block air from escaping a puncture hole (PO Resp. 13), and with the evidence and testimony of record that adhesives, particularly PVA, do, in fact, provide additional sealing capability. Moreover, regarding the ratio of adhesive agent to total weight, the ’041 patent states that if “the ratio is less than 5% by weight, the adhesiveness of the puncture sealing agent is low so that the sealing ability and seal maintaining ability of the puncture sealing agent are insufficient.” Ex. 1001, 3:61–65. This implies that a ratio above 5% by weight would be adequate to “improve the sealing ability of the puncture sealing agent.” *Id.* at 3:58–59. Finally, Haifeng indicates that previous tire sealants “are not very satisfactory, and the adhesiveness and sealing performance are poor” due to the “single component of the sealant used,” but that the tire sealant of

its invention, which includes PVA in both Embodiment 1 and Embodiment 2, “has excellent sealing performance.” Ex. 1002, 3. This also evidences the “additional sealing capability” of Haifeng’s PVA-containing composition.

Thus, on this complete record, we find that Haifeng’s identification of polyvinyl alcohol as an adhesive and in the amount of 5.1% by weight meets the limitations of claim 2.

c. Claim 4

For claim 4, which further comprises “one of fibers and fibrous materials that enhance sealing capability,” Petitioner asserts that Haifeng discloses asbestos and natural and synthetic fibers. Pet. 16 (citing Ex. 1002, 3). Petitioner asserts: “Asbestos is a well-known fibrous material used in tire sealants.” *Id.* (citing Ex. 1011 ¶ 91).

Patent Owner faults Petitioner for failing to offer proof that “Haifeng discloses fibers of the type and amount that would enhance sealing.” PO Resp. 25. Patent Owner argues that Haifeng discloses fibers that act as a reinforcing agent, that this is not synonymous with components that “enhance sealing capability,” and that one of ordinary skill in the art would understand that a “reinforcing agent” does something different than an agent that provides “sealing capability.” *Id.* at 25–26.¹³

Petitioner replies that fibers such as asbestos “are commonly used in tire sealants to improve the sealing capability.” Reply 11 (citing Ex. 1024

¹³ Patent Owner also makes arguments regarding fiber length that appear to relate only to claim 5. PO Resp. 27–28. Because Petitioner does not argue that claim 5 is anticipated, we make no findings as to whether Haifeng anticipates the additional limitation of claim 5.

¶¶ 47–54). Regarding Patent Owner’s contention that asbestos fibers are merely reinforcing agents rather than agents that “enhance sealing capability,” Petitioner relies on its expert’s statement: “If you see an improvement in the ability for the sealant to prevent the leakage of air,” such as with asbestos fibers, “it’s fair to say that that ingredient enhances the sealing capability of the product.” *Id.* at 11–12 (citing Ex. 1025, 71:8–72:1).

Patent Owner responds that Petitioner’s argument is new as well as incorrect. Sur-Reply 12. First, Patent Owner argues that Petitioner’s expert admits that one cannot assume that fibers will enhance sealing. *Id.* (citing Ex. 2011, 105:19–22; 115:17–24). Second, Patent Owner argues that a new argument that “sealing capability” encompasses everything is also unsupported and incorrect. *Id.*

On this record, we do not find Petitioner’s arguments new, but properly responsive. We are persuaded that Petitioner’s identification of Haifeng’s asbestos and natural and synthetic fibers, as supported by its declarant’s testimony, meets this limitation of claim 4. Pet. 16; Ex. 1011 ¶ 91 (citing Ex. 1008, 1:42–48, 2:6–8). Haifeng’s identification of its fibers as “reinforcing agents,” i.e., agents that reinforce the strength of the composition, appears to be generally synonymous with components that “enhance sealing capability” as required by claim 4. Ex. 1002, 3. Even applying Patent Owner’s claim construction that “enhance sealing capability” means the sealant’s capability to block air from escaping a puncture hole is enhanced, Petitioner’s identification of Haifeng’s asbestos fibers meets this limitation. PO Resp. 13.

Not only does Haifeng itself define its fibers as reinforcing agents, which would appear to be generally synonymous with agents that “enhance

sealing capability,” but testimony confirms that fibers and fibrous materials such as those found in Haifeng “enhance sealing capability”: Dr. Incavo opined that “fibers are known to: (1) promote clotting; (2) speed up the sealing of the puncture hole; and (3) improve the physical properties of the tire sealants, including resilience, toughness, and tensile strength,” and “all of these functions make the tire sealant better.” Ex. 1024 ¶ 49.

Thus, on this complete record, we find that Haifeng’s identification of asbestos meets the limitations of claim 4.

d. Claim 9

For claim 9, which requires a surfactant that is “one of an anionic surfactant, an ampholytic surfactant, a carboxylic acid type surfactant and an aliphatic acid salt,” Petitioner contends that Haifeng’s composition may include a leveling agent O, sodium petroleum sulfonate, sodium rosinate, an emulsifier OP, or sodium dodecylbenzenesulfonate. Pet. 16–17 (citing Ex. 1002, 4). Petitioner contends “[s]uch additives are well-known surfactants, and at least one is an anionic surfactant, an ampholytic surfactant, a carboxylic acid type surfactant and an aliphatic acid salt.” Pet. 17 (citing Ex. 1011 ¶ 92).

Patent Owner contends Petitioner “did not prove that Haifeng discloses one of a specific list of claimed surfactants.” PO Resp. 28. According to Patent Owner, Petitioner fails to point to a disclosure of one of the specific surfactants of claim 9, namely, “an anionic surfactant, an ampholytic surfactant, a carboxylic acid type surfactant and an aliphatic acid salt.” *Id.* at 28–29 (analyzing Exs. 1018–1022).

Petitioner replies that “Haifeng discloses ‘sodium petroleum sulfonate,’ which is a commonly known anionic surfactant.” Reply 12–13 (citing Ex. 1011 ¶ 92; Ex. 1024 ¶ 57).

Patent Owner responds that Petitioner impermissibly relies on new Exhibit 1059, and still has no evidence that sodium petroleum sulfonate is an anionic surfactant. Sur-Reply 14.

We note, initially, that Exhibit 1059 appears to be a resubmission of Exhibit 1019, and, as such, is not new. Petitioner relies upon sodium petroleum sulfonate as an anionic surfactant. Pet. 16–17 (citing Ex. 1011 ¶ 92 (citing, *inter alia*, Ex. 1019, disclosing that sodium petroleum sulphonates “are unique materials because of their dual function as surfactants and rust inhibitors”); Ex. 1059 (apparent resubmission of Ex. 1019)). One end of the sodium petroleum sulfonate molecule “functions as” an anionic surfactant. Ex. 1019, 1 (the “polar nature of the sulfonate end of the molecule functions as a typical anionic surfactant”). The end of the molecule is still a part of the molecule. Upon considering the evidence of record, we find that a skilled artisan would understand that the molecule is an anionic surfactant for at least the reason that a portion of the molecule ‘functions as’ an anionic surfactant.

We find that the compounds Petitioner identifies as being disclosed in Haifeng satisfy the claim 9 requirement for “surfactants.” Haifeng’s list of stabilizers, coupled with Petitioner’s declarant’s testimony that these stabilizers are well-known surfactants (Ex. 1011 ¶ 92 (citing Exs. 1018–1022)), establishes Petitioner’s case with respect to claim 9.

e. Claims 3, 17, and 20

For independent claim 17, Petitioner asserts that Haifeng discloses a puncture sealing agent that has a rubber latex, an adhesive agent, and 5 to 50% by weight glycerin, generally relying on similar arguments to those presented for claims 1 and 2. Pet. 17–18. Petitioner asserts that Haifeng discloses mixing an adhesive agent with a rubber latex while stirring to yield a mixture, because Haifeng’s method includes placing styrene-butadiene latex in a mixing kettle with a stirrer, and gradually adding polyvinyl alcohol and sodium nitrite under constant stirring. *Id.* at 18 (citing Ex. 1002, 4). Petitioner asserts that Haifeng discloses mixing a glycerin solution with the mixture to form the puncture sealing agent, because Haifeng’s method includes adding the glycerin, uniformly stirring the mixture, and bottling to obtain the finished product. *Id.* (citing Ex. 1002, 4).

For claim 3, Petitioner asserts that Haifeng discloses the required “anti-corrosion agent” with its disclosure that the “corrosion inhibitor used in the present invention includes nitrites, molybdates, tungstates, chromates, organic amines, sodium hexametaphosphate and the like.” Pet. 16 (citing Ex. 1002, 4).

For claim 20, which requires that “the mixture further comprises mixing a plurality of fibers into the mixture,” Petitioner asserts that Haifeng discloses the use of “asbestos” and “natural and synthetic fibers.” Pet. 19 (citing Ex. 1002, 3; Ex. 1011 ¶ 96).

Patent Owner does not present separate arguments against Petitioner’s challenges to claims 3, 17, and 20. We have reviewed Petitioner’s unchallenged assertions and evidence as to claims 3, 17, and 20, and conclude that the record supports Petitioner’s contentions as to these claims.

Accordingly, for the reasons given above, we find that Petitioner has shown claims 1–4, 9, 17, and 20 of the '041 patent are anticipated under 35 U.S.C. § 102(b) by Haifeng.

ii. Asserted Obviousness over Haifeng in View of Boxi (Ground 2)

Petitioner argues that the subject matter of claims 1–4, 9, 17, and 20 would have been obvious to a person of ordinary skill in the art under 35 U.S.C. § 103(a) over Haifeng in view of Boxi. Pet. 19–29.

For claims 1 and 2, Petitioner asserts Haifeng discloses a tire sealant including a rubber latex, 8.6% glycerin anti-freezing agent, and 5.1% polyvinyl alcohol adhesive agent. *Id.* at 19–21. Petitioner asserts that Boxi discloses a sealant for a tire including a latex binder and glycerin antifreeze, i.e., glycerol (5–40%). *Id.* at 20. For claim 2, Petitioner contends that Boxi discloses an adhesive agent between 5% and 30% by weight, because Boxi discloses carboxymethylcellulose, a known adhesive, dissolved in water at a concentration of 3%–15%. *Id.* at 21 (citing Ex. 1011 ¶ 100).

For claim 3, Petitioner asserts that Haifeng and Boxi disclose the required “anti-corrosion agent” with their respective disclosures of a “nitrites, molybdates, tungstates, chromates, organic amines, sodium hexametaphosphate and the like” (Ex. 1002, 4), and “nitrates, nitrites and the like” (Ex. 1003, 2). Pet. 21–22.

For claim 4, Petitioner asserts that both references disclose “fibers and fibrous materials that enhance sealing capability of puncture sealing agent,” because Haifeng discloses the use of “asbestos” and “natural and synthetic fibers” (citing Ex. 1002, 3), and that Boxi discloses fibrous fillers including cotton, asbestos, and synthetic fibers (citing Ex. 1003, 3). Pet. 22.

For claim 9, Petitioner asserts that Haifeng discloses a surfactant that is one of an anionic surfactant, an ampholytic surfactant, a carboxylic acid type surfactant and an aliphatic acid salt, because Haifeng's composition may include a leveling agent O, sodium petroleum sulfonate, sodium rosinatate, an emulsifier OP, or sodium dodecylbenzenesulfonate. Pet. 22–23 (citing Ex. 1002, 4).

For independent claim 17, Petitioner asserts that Haifeng and Boxi disclose a puncture sealing agent that has a rubber latex, an adhesive agent, and 5 to 50% by weight glycerin, generally relying on similar arguments to those presented for claims 1 and 2. Pet. 23–24. Petitioner asserts that Haifeng discloses mixing an adhesive agent with a rubber latex while stirring to yield a mixture, because Haifeng's method includes placing styrene-butadiene latex in a mixing kettle with a stirrer, gradually adding polyvinyl alcohol and sodium nitrite under constant stirring, adding glycerin, uniformly stirring the mixture, and bottling to obtain the finished product. *Id.* at 24–25 (citing Ex. 1002, 4).

For claim 20, Petitioner argues that both references disclose “mixing a plurality of fibers into the mixture,” because Haifeng discloses the use of “asbestos” and “natural and synthetic fibers” (citing Ex. 1002, 3), and that Boxi discloses fibrous fillers including cotton, asbestos, and synthetic fibers (citing Ex. 1003, 3). Pet. 25.

Regarding motivation to combine, Petitioner asserts that one of skill in the art “would have been motivated to modify Haifeng's sealant with the teachings of Boxi to ‘adjust’ the tire sealant with a component mixture ‘ratio’ suitable for a ‘region’ requiring improved cold weather performance, as taught by Boxi's sealant, which includes adjusting the

concentration of glycerin upward.” Pet. 27 (citing Ex. 1011 ¶ 108). Petitioner contends “making a tire sealant with conventional additives, including glycerin at a ratio of 5%–50% of the total weight of the tire sealant, is nothing more than an anticipated, obvious, and routine application of known elements.” *Id.* at 28 (citing Ex. 1011 ¶¶ 108–112).

a. Latex

Patent Owner asserts that Petitioner did not prove that either Haifeng or Boxi discloses a “rubber latex” as claimed, or that using a rubber latex would have been obvious. PO Resp. 30 (emphasis omitted). Patent Owner asserts that “Boxi’s disclosure of a broad genus—here, ‘latex’—cannot constitute disclosure of every species within it.” *Id.* at 30–31 (citing *Wasica Fin. GmbH v. Cont’l Auto. Sys.*, 853 F.3d 1272, 1284, 1285 (Fed. Cir. 2017) (“It is well established that disclosure of a genus in the prior art is not necessarily a disclosure of every species that is a member of that genus.”)). Moreover, Patent Owner argues, the latex category is broad, including many different types of non-rubber latexes. *Id.* at 31.

Petitioner replies that “Boxi uses the abbreviated term ‘latex’ to refer to rubber latex,” as does much of the prior art. Reply 14 (citing Ex. 1024 ¶¶ 65–68). Petitioner argues that because there are only two categories of latex—rubber latex and “non-rubber” latex—and because the genus of latex is very small, one of ordinary skill in the art “would have easily interpreted Boxi as disclosing rubber latex.” *Id.* at 15 (citing Ex. 1024 ¶ 68).

Patent Owner responds that Petitioner’s new argument for why Boxi allegedly discloses “rubber latex” is untimely and unsupported. Sur-Reply 14. First, Patent Owner disagrees that only rubber latex works in a tire sealant, pointing to examples of non-rubber latex in tire sealants. *Id.*

at 14–15 (citing Ex. 1005, 7:63–64, 10:1; Ex. 1010, 3:44–46). Second, Patent Owner argues that none of Petitioner’s new exhibits support that “latex” is shorthand for “rubber latex.” *Id.* at 15. Third, Patent Owner argues that rubber latex and non-rubber latex are sub-genuses under the genus latex, which has hundreds of compounds, and therefore Petitioner’s argument is inapposite. *Id.* at 15–16.

Above, we determined that Haifeng sufficiently discloses the claimed “rubber latex.” On this complete record, we also review Boxi’s disclosure to determine whether it sufficiently discloses the claimed “rubber latex.” Boxi uses the term “latex” only three times. Ex. 1003, 2 (claim 2, “The binder according to claim 1, comprising cellulose derivatives, polyvinylpyrrolidone, latex, 107 glue, polyacrylamide, polyacrylic acid or the like, the content being 1-20% (wt%).”), 3 (same language as claim 2), *id.* (“The embodiment of the present invention is as follows: carboxymethyl cellulose was dissolved in water, the concentration being 3%-15%; a latex was added, the concentration being 3%-15% . . .”). Boxi does not provide additional details about its latex. Moreover, Boxi does not appear to use the word “rubber” at all. *See generally id.* Patent Owner, with supporting testimony, argues that “latex” generally can include both “rubber latex” and “non-rubber latex,” and is not limited to “rubber latex.” PO Resp. 30–32. While Boxi’s use of the term “latex” might include rubber and non-rubber latex, we are not persuaded that this general disclosure would suggest to a person of ordinary skill in the art the use of rubber latex, as opposed to a non-rubber latex. *Id.* at 30–31; Sur-Reply 14 (citing *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1361 (Fed. Cir. 2011) (“To render a claim obvious, prior art cannot be ‘vague’ . . .”)). Although Petitioner points to

evidence to argue that “latex” and “rubber latex” may be used interchangeably (Reply 14–15 (citing Ex. 1024 ¶¶ 65–68) (referring to Ex. 1024 ¶ 28) (examples of the ’041 patent first referring to “rubber latex” and then using the shorthand “latex”)), we are not persuaded that Boxi uses the term “latex” in this manner. In this regard, we note that Boxi has no “rubber” term to interchange with its bare mention of “latex.” Thus, at best, it appears that Boxi is vague about the characteristics of its latex, which is insufficient to form the basis for an obviousness challenge.

b. Combination of Haifeng and Boxi

Patent Owner asserts, “Petitioner provided no argument, much less any obviousness rationale or reason, for substituting Boxi’s ‘latex’ into Haifeng.” PO Resp. 32. Patent Owner argues that Petitioner’s reasons for combining are directed primarily to reasons for including Boxi’s glycerin in Haifeng’s composition, not to the specific combination of including Boxi’s latex in Haifeng’s composition. *Id.*

On this complete record, we are unpersuaded by Petitioner’s argument for combining the references, and regarding reasonable expectation of success with respect to latex. We discern no reason to modify Haifeng’s rubber latex to have the properties of Boxi’s latex, in the proportions Boxi discloses, if Boxi does not disclose a rubber latex in the first place. As discussed above, we are not persuaded that Boxi sufficiently identifies a “rubber latex” that could be combined with Haifeng. Even if we were, Petitioner does not argue that there would be motivation to combine Boxi’s latex with Haifeng with a reasonable expectation of success. Pet. 25–30. Because each of the claims challenged under this ground requires a “rubber

latex,” this shortcoming is not overcome by any of Petitioner’s other arguments.

Petitioner’s motivation to combine Haifeng and Boxi is predicated on the assertion that both the references disclose “tire sealant compositions with many conventional additives.” Pet. 26. “An invention is not obvious just ‘because all of the elements that comprise the invention were known in the prior art.’” *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013) (quoting *Power-One, Inc. v. Artesyn Techs., Inc.*, 599 F.3d 1343, 1351 (Fed. Cir. 2010)). Instead, “a finding of obviousness at the time of invention requires a ‘plausible rational[e] as to why the prior art references would have worked together.’” *Id.* (quoting *Power-One*, 599 F.3d at 1351).

As we noted in our Institution Decision, Petitioner’s reasons for making the combination are directed primarily to reasons for including Boxi’s glycerin in Haifeng’s composition. Dec. 19. We further noted that Petitioner does not appear to provide a specific rationale for using Boxi’s carboxymethylcellulose as an adhesive in Haifeng, other than a statement that a person of ordinary skill in the art would “adjust” the tire sealant of Haifeng with conventional additives and glycerol. *Id.* (citing Pet. 28). We agree with Patent Owner that, even if Boxi’s carboxymethylcellulose “is a known adhesive” or “conventional additive” for tire sealants, that is not in and of itself a reason to add it to Haifeng, let alone adjust the ratio. PO Resp. 35 (citing *KSR*, 550 U.S. at 418 (“a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art”)). Patent Owner also notes, and we agree, that “Haifeng’s discussion about how ingredients can be ‘adjusted’ refers only to the ‘ratio’ of Haifeng’s ingredients, not to

substituting in any new ingredients.” *Id.* at 35 n.7 (citing Ex. 1002, Abstract; Ex. 2010 ¶ 89).

Although the inclusion of carboxymethylcellulose might be possible, there is no persuasive articulation of a motivation to do so, nor of a reasonable expectation of success in the combination. In addition to a reason to combine the prior art references, proving obviousness requires showing that a person of ordinary skill in the art would have had “a reasonable expectation of achieving what is claimed in the patent-at-issue.” *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016). Petitioner argues generally that “combining the materials of Haifeng with the materials of Boxi,” without specifying exactly which materials or how to combine them, “would pose no technical challenges and would not require any changes in the function of Haifeng’s or Boxi’s materials.” Pet. 29 (citing Ex. 1011 ¶ 113). The testimony on reasonable expectation of success, however (Ex. 1011 ¶ 113), points only to the two references themselves and identifies no other persuasive evidence that the unspecified ingredients could be combined or adjusted in the manner required by the challenged claims with a reasonable expectation of success. *See* 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Rohm & Haas Co. v. Brotech Corp.*, 127 F.3d 1089, 1092 (Fed. Cir. 1997). We do not discern adequate support for Petitioner’s proposition that one of ordinary skill in the art could alter the proportions of the components in Haifeng’s composition without altering its effectiveness. Petitioner’s reliance on Haifeng’s statement that proportions can be

“adjusted” does not lead to the conclusion that any adjustment of Haifeng’s ratios could be reasonably expected to be successful.

On this complete record, we are unpersuaded by Petitioner’s argument for combining the references and regarding reasonable expectation of success. For these reasons, we are not persuaded that Petitioner has demonstrated by a preponderance of the evidence that claims 1–4, 9, 17, and 20 would have been obvious over Haifeng in view of Boxi.

iii. Asserted Obviousness over Haifeng in View of Kishida and Guihe (Ground 3)

Petitioner argues that “claims 1–5,^[14] 9, 17, and 20 are invalid as obvious over Haifeng in combination with Kishida.” Pet. 30–41.

a. Combination with Kishida

For claims 1 and 2, Petitioner asserts Haifeng discloses a tire sealant including a rubber latex, 8.6% glycerin anti-freezing agent, and 5.1% polyvinyl alcohol adhesive agent. Pet. 30–32. Petitioner contends that Kishida discloses a puncture sealing agent comprising a rubber latex, because Kishida’s puncture sealing agent includes a natural rubber latex, or replaces one part of the natural rubber latex with a synthetic rubber latex. Pet. 31. Petitioner contends Kishida discloses ethylene glycol as a “generally adopted” anti-freezing agent, which a person of ordinary skill in

¹⁴ The summary of the grounds on page 4 of the Petition lists claims 1–4 as being challenged under this ground, whereas the arguments starting on page 30 of the Petition list claims 1–5. The summary of the grounds on page 4 of the Petition also identifies Guihe as one of the references relied upon in this ground, but the arguments starting on page 30 of the Petition do not state that Petitioner is relying on Guihe in this ground. Petitioner, however, presents arguments based on Haifeng and Guihe for claim 5 (Pet. 33), and therefore we consider claim 5 and Guihe to be part of this ground.

the art would recognize as interchangeable with glycerin. *Id.* (citing Ex. 1004 ¶ 5). Petitioner contends that Kishida teaches a ratio of antifreezing agent in an amount between 5 and 75% by weight, because Kishida discloses that propylene glycol is used as an anti-freezing agent in a ratio of 20 to 40% of the total weight of the puncture sealing agent. Pet. 32 (citing Ex. 1004 ¶ 13). Regarding motivation to combine, Petitioner contends that one skilled in the art “would have been motivated to modify Haifeng’s sealant with the teachings of Kishida to ‘adjust’ the tire sealant with a component mixture ‘ratio’ that improves long-term stability for an extended service life, as taught by Kishida’s sealant.” Pet. 39 (citing Ex. 1011 ¶ 128). Petitioner contends that making “a tire sealant with glycerin and other conventional additives (such as anti-corrosion agents and fibers) is nothing more than an anticipated, obvious, and routine application of known elements.” *Id.* (citing Ex. 1011 ¶¶ 130–131). Regarding reasonable expectation of success, Petitioner argues that the combination “would yield nothing more than predictable results to a PHOSITA” and “to the extent different concentrations of different additives must be tried before arriving at a suitable composition, such work is in the realm of routine experimentation.” *Id.* at 41 (citing Ex. 1011 ¶¶ 127–132).

Patent Owner argues that in “this ground, Petitioner raised one obviousness theory for independent claims 1, 17, and 20: it would have allegedly been obvious to substitute Haifeng’s glycerin into Kishida, i.e., Kishida in view of Haifeng.” PO Resp. 38. Patent Owner argues that this theory fails “because Petitioner did not provide legally sufficient evidence of a motivation for making such a substitution.” *Id.* Patent Owner contends that “Petitioner incorrectly argued that because glycerin and ethylene glycol

are listed as alternatives in some tire sealant references that they would have been *per se* ‘interchangeable’ in all tire sealants.” *Id.* at 39 (emphasis omitted). Patent Owner argues that the differences between ethylene glycol and glycerin, such as different freezing point depression properties, different viscosities, and potentially other property differences, make them not “interchangeable.” *Id.* at 40–41 (citing Ex. 2011, 128:7–130:2).

Petitioner replies that “the challenged claims recite a combination of elements that were all known in the prior art, and all that was required to obtain that combination was to substitute one well-known anti-freeze agent for another.” Reply 20. Petitioner states that glycerin “was a known anti-freeze agent in tire sealants containing rubber latex prior to 2006.” *Id.* at 17. Petitioner further replies that Dr. Incavo “opined that glycerin was interchangeable with both propylene glycol and ethylene glycol,” and thus using “glycerin instead of propylene glycol is a matter of simple substitution.” *Id.* (citing Ex. 1024 ¶¶*; Ex. 1001 ¶¶ 128–129, 146–147). Petitioner criticizes Dr. Daniels’s opinion regarding undue experimentation as “not credible” due to his failure to analyze the similarities between Kishida’s process and the ’041 patent’s process for making a tire sealant. *Id.* at 18. Petitioner reiterates that “a skilled artisan would know that glycerin could be used in Kishida’s tire sealant without undue experimentation based on: (1) close structural and chemical similarity of glycerin and propylene glycol; and (2) the fact that the prior art use both glycerin and propylene glycol as anti-freeze agents in tire sealants.” *Id.* at 19 (citing Ex. 1024 ¶¶ 76, 85). Petitioner also argues that there are a finite number of anti-freeze agents commonly used in tire sealants, and glycerin is one of them. *Id.* (citing *KSR*, 550 U.S. at 421).

Patent Owner responds that Petitioner's expert admitted that ethylene glycol and glycerin are not interchangeable. Sur-Reply 17 (citing PO Resp. 39 (citing Ex. 2011, 123:6–9 (“Q. So, in your opinion, glycerin is interchangeable with ethylene glycol in all tire sealants? A. Not necessarily, no.”), 124:22–125:2)). Patent Owner also alleges that (1) Petitioner's argument that Kishida's propylene glycol would also have been interchangeable with glycerin was not in the Petition (*id.*); (2) “Petitioner falsely claims this new theory is ‘unrebutted’” (*id.* at 18); (3) Dr. Incavo admitted that propylene glycol and glycerin are not interchangeable (*id.* at 19 (citing Ex. 1024 ¶ 91 (describing test results in the video at Ex. 1060 showing glycerin and propylene glycol have different properties))); and (4) Petitioner “erroneously implies that propylene glycol and glycerin are interchangeable because ‘the only change that [the ‘041 patent inventors] made to Kishida's written description was replacing ‘propylene glycol’ with ‘glycerin’” (*id.*).

Patent Owner characterizes this ground as “obvious to substitute Haifeng's glycerin into Kishida, i.e., Kishida in view of Haifeng.” PO Resp. 38. Although Kishida's focus is on “the use of propylene glycol as an antifreezing agent,” Kishida discloses use of both ethylene glycol in the prior art, and its own use of propylene glycol, as anti-freeze agents in tire sealant compositions. Ex. 1004 ¶¶ 8, 10, Table 1 (disclosing ethylene glycol in an example according to the prior art). Kishida does not disclose glycerin at all.

For independent claim 1, Petitioner argues that Kishida's ethylene glycol and Haifeng's glycerin are interchangeable, and later for the same claim relies on Kishida's propylene glycol to disclose the required 5–75%

ratio of glycerin to total weight. Pet. 31. For independent claim 17, Petitioner relies on Kishida's propylene glycol to disclose the ratio and mixing step. *Id.* at 36–37. Petitioner also argues in its Reply that propylene glycol (from Kishida) is interchangeable with glycerin (from Haifeng). Reply 17. Petitioner's arguments, however, are unpersuasive on this complete record.

Although Petitioner argues that “Haifeng expressly teaches that glycerin and other antifreezing agents are interchangeable” (Pet. 38 (citing Ex. 1002, 4)), we do not read Haifeng as supporting this broad an assertion, because Haifeng merely provides a list of the possible “antifreeze used in the present invention” without making any representations as to the universal interchangeability of the items on its list. Ex. 1002, 4. In other words, while Haifeng discloses that its various antifreezes may be used in various compositions, it does not necessarily follow that all of Haifeng's antifreezes may be substituted interchangeably into every possible composition. We also are not persuaded by Petitioner's assertions that “glycerin is readily interchangeable with other antifreezing agents.” Pet. 38 (citing Ex. 1008, 4:12–27; Ex. 1002, 4; Ex. 1005, 4:29–35; Ex. 1014, 1:35–39). Patent Owner demonstrates that it is not necessarily a simple substitution to use glycerin rather than ethylene glycol, or to use glycerin rather than propylene glycol, in a tire sealant composition. PO Resp. 38–43 (citing Ex. 2011, 123:6–9, 124:22–125:2, 128:7–130:2; Ex. 2016 ¶ 49; Ex. 1004 ¶¶ 5–8; Ex. 2010 ¶ 85). Simply because one chemical compound may be substituted for another in one instance, or is identified as a possible alternative in another instance, does not make that compound *de facto* or even readily “interchangeable” with another. *See, e.g., Eli Lilly & Co. v Generix Drug*

Sales, Inc., 460 F.2d 1096, 1104 (5th Cir. 1972) (chemical compounds present “riddle wrapped in a mystery inside an enigma”—finding enantiomer is not equivalent of the racemate); *In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995) (chemistry is “less predictable field” where “minor changes in a product or process may yield substantially different results”). Finally, Petitioner’s presentation of a blackline copy of Kishida against the ’041 patent to argue its point that Kishida merely replaced the words “propylene glycol” with the word “glycerin” is incomplete proof that the two are interchangeable and, in the absence of any law or precedent in support thereof, unpersuasive. Ex. 1024 ¶¶ 80–83. Petitioner has not persuaded us, on this record, that simple substitution of propylene glycol or ethylene glycol with glycerin would have been obvious, because chemicals have unpredictable properties.

b. Combination with Guihe - Claim 5

For claim 5, Petitioner asserts that Guihe discloses microfibers having a length of 0.05 mm to 2.0 mm. Pet. 33 (citing Ex. 1007, p. 2). The Petition does not make any arguments that there would have been motivation to combine Guihe with Haifeng and/or Kishida with a reasonable expectation of success. The section of the Petition addressing motivation to combine in relation to this ground of unpatentability mentions only the combination of Haifeng and Kishida. *Id.* at 37–41. Patent Owner does not make any separate arguments regarding Petitioner’s claim 5 arguments. *See generally* PO Resp. Petitioner reiterates its claim 5 assertions in its Reply, and adds that “skilled artisans would be further motivated to combine Guihe with the teaching of Haifeng and Kishida because Guihe states that the ‘microfibers can produce a mixed polymer [sealant] to increase the strength of the

[sealant] and the service life in a tire” Reply 21 (citing Ex. 1007, 2). Patent Owner asserts that for “the first time on Reply, Petitioner raises two new motivations,” which still fail because Petitioner “provides no motivation to add fibers of 1–150 microns to Haifeng.” Sur-Reply 21–22.

As we previously noted, the Petition relied on Guihe in this ground only, to disclose an alternative measurement for asbestos fibers. Dec. 24. Additionally, the Petition never presented any obviousness argument with respect to the combination of Guihe with Haifeng and Kishida, other than to state that Guihe discloses microfibers of a particular length. *Id.* (citing Pet. 33, 39). The Reply presents arguments that one of ordinary skill in the art would understand that fibers like Haifeng’s and Guihe’s “must be somewhere within the range of 1 micron to 150 microns.” Reply 21. The Reply also newly presents an argument that one of ordinary skill in the art would be motivated to combine Guihe with Haifeng and Kishida. *Id.* (citing Ex. 1007, 2) (citing Guihe’s statement that “microfibers can produce a mixed polymer [sealant] to increase the strength of the [sealant] and the service life in a tire”). This newly presented argument does not cure the deficiency in the Petition discussed above. Where the Petition fails to provide a motivation to combine with reasonable expectation of success, the Reply cannot cure this failure. “A reply may only respond to arguments raised in the corresponding opposition, patent owner preliminary response, or patent owner response.” 37 C.F.R. § 42.23(b); *see Intelligent Bio-Sys.*, 821 F.3d at 1369 (citing 35 U.S.C. § 312(a)(3)) (“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that

supports the grounds for the challenge to each claim.”). Accordingly, Petitioner’s argument is insufficient with respect to claim 5.

On this complete record, we are unpersuaded by Petitioner’s argument and evidence that claims 1–5, 9, 17, and 20 would have been obvious over Haifeng in view of Kishida and Guihe.

iv. Asserted Obviousness over Boxi in View of Kishida (Ground 4)

Petitioner argues that the subject matter of claims 1–4, 9, 17, and 20 would have been obvious to a person of ordinary skill in the art under 35 U.S.C. § 103(a) over Boxi in view of Kishida. Pet. 41–50.

For claim 1, Petitioner asserts that Boxi discloses a tire sealant composition including cellulose derivatives, a latex binder, and 5–40% glycerol. *Id.* at 42 (citing Ex. 1003, 3). Petitioner asserts that Kishida discloses a tire sealant composition including natural or synthetic rubber latex and 20 to 40% by weight propylene glycol antifreezing agent. *Id.* at 42–43 (citing Ex. 1004 ¶ 13).

Petitioner asserts one skilled in the art “would have been motivated to modify Boxi’s improved cold weather tire sealant to improve the sealant’s stability by using the component mixtures, as taught by Kishida, resulting in a sealant with an extended and long-term service life.” *Id.* at 48 (citing Ex. 1011 ¶ 146).

Patent Owner argues that “Ground 4 fails for the same reasons” as those in Grounds 2 and 3. PO Resp. 48. More particularly, Patent Owner argues:

Petitioner has not shown that (a) Boxi discloses “rubber latex,” (b) it would have been obvious to substitute Boxi’s glycerin for ethylene glycol in Kishida, (c) Boxi discloses an adhesive with “additional sealing capability,” (d) there would have been a

motivation to add one of Kishida's adhesives to Boxi, (e) Boxi discloses fibers that "enhance sealing capability," (f) there would be any motivation to add Kishida's fibers to Boxi, or (g) any of Kishida's fibers would "enhance sealing capability" in Boxi.

Id. (citing PO Resp. §§ III.B., III.C.; Ex. 2010 ¶¶ 96–101). Patent Owner also challenges Petitioner's motivation for combining Kishida's surfactants with Boxi to meet the limitations of claim 9. *Id.* at 48–49.

We have reviewed Petitioner's argument and evidence that claims 1–4, 9, 17, and 20 would have been obvious over Boxi in view of Kishida, and considered Patent Owner's arguments against this ground. Our analysis of Petitioner's and Patent Owner's arguments on this ground and on this record is largely coextensive with the analysis presented above with respect to the earlier combinations involving the same prior art. Namely, Boxi does not suggest "rubber latex," and Kishida's lack of disclosure of glycerin is not cured by Boxi's disclosures. Petitioner's motivation to combine and reasonable expectation of success arguments are similarly flawed. For example, Petitioner provides no motivation for substituting Boxi's glycerol in place of Kishida's ethylene glycol, other than to say the two compounds are "readily interchangeable." Pet. 47; PO Resp. 48. Additionally, Petitioner relies on its expert's very general statements that the combination would yield a reasonable expectation of success. Pet. 49–50 (citing Ex. 1011 ¶ 150). For the same reasons given above, we determine that Petitioner has not met its burden of demonstrating by a preponderance of the evidence that claims 1–4, 9, 17, and 20 would have been obvious over Boxi in view of Kishida.

v. *Asserted Obviousness over Haifeng in View of Wong and Jaksa (Ground 5)*

Petitioner argues that the subject matter of claims 26, 27, 29, 30, and 32 would have been obvious to a person of ordinary skill in the art under 35 U.S.C. § 103(a) over Haifeng in view of Wong and Jaksa. Pet. 50–58.

For claim 26, Petitioner asserts Haifeng discloses a tire sealant including a rubber latex, 8.6% glycerin anti-freezing agent, and a polyvinyl alcohol adhesive agent. *Id.* at 50–52. Petitioner asserts that Wong discloses a tire puncture sealant including a SBR latex, a cellulosic thickener such as xanthan gum, and a freeze preventative components, e.g., ethylene glycol, propylene glycol or glycerine. *Id.* at 51–52 (citing Ex. 1005, Abstract, 1:48–50, 2:33–40, 4:30–35). Petitioner asserts that Wong discloses its sealant may include a polymeric component “selected from the group consisting of crushed and ground, recycled post-consumer tire material tire rubber, ultra high molecular weight polyethylene, and mixtures thereof.” *Id.* at 52 (citing Ex. 1005, 2:17–20). Petitioner asserts that Jaksa discloses known tire sealants including “chunks of natural rubber.” *Id.* (citing Ex. 1009, 1:9–15).

For claim 27, Petitioner asserts that Wong’s disclosure of “a cellulosic thickener” and Haifeng’s disclosure of “bentonite” teach the limitation “a thickening agent mixed into the agent, the thickening agent further comprises one of a clay thickener, a cellulose thickener, and a natural gum.” *Id.* at 53 (citing Ex. 1005, Abstract, 1:48–50; Ex. 1002, 2; Ex. 1011 ¶ 156).

For claim 29, Petitioner asserts Haifeng discloses the use of asbestos and natural and synthetic fibers that one skilled in the art would have known would “form an interlocking network that promotes clotting and outbound passage of air from a tire.” *Id.* at 54 (citing Ex. 1011 ¶ 157).

For claim 30, Petitioner asserts that Haifeng’s “corrosion inhibitor” and Wong’s tire sealant containing “conventional additives” such as “a corrosion inhibitor” teach “a corrosion inhibitor mixed into the agent.” *Id.* at 54 (citing Ex. 1002, 4; Ex. 1005, 2:23–25).

For claim 32, Petitioner asserts Wong teaches a ratio of 1–10% rubber latex by weight, because Wong discloses SBR latex in an amount of about 3%. *Id.* at 54–55. Petitioner asserts that Wong teaches a ratio of 1–10% adhesive agent by weight, because Wong teaches about 3% to about 6% by weight particulate polymeric component. *Id.* at 55.

Regarding motivation to combine, Petitioner contends that “Haifeng and Wong teach tire sealant compositions [with] many conventional additives.” *Id.* at 56. Petitioner points out that Wong states that “if the viscosity falls below the desired value, a small addition of thickener should correct the condition.” *Id.* at 57 (citing Ex. 1005, 5:62–64). Petitioner also argues that one skilled in the art “would have been motivated to modify Haifeng’s sealant with a thickening agent or chunks of rubber, as taught by Wong and Jaksa, to create a tire sealant with increased dispersion characteristics to improve tire-sealing capabilities.” *Id.* at 58 (citing Ex. 1011 ¶¶ 161–162). Petitioner contends “[s]uch a combination would not require any changes in the function of Haifeng’s, Wong’s, or Jaksa’s materials, and the combination would yield nothing more than predictable results.” *Id.* (citing Ex. 1011 ¶¶ 161–162).

a. Motivation to Combine and Reasonable Expectation of Success

Patent Owner challenges Petitioner’s motivation to combine the references with reasonable expectation of success. PO Resp. 51–55. Specifically, Patent Owner alleges that it is “unclear from the record . . .

exactly which references Petitioner relies on to meet this limitation.” *Id.* at 52–53 (referring to the rubber chunks limitation of claim 26 and dependent claims) (citing *In re Kotzab*, 217 F.3d 1365, 1370 (Fed. Cir. 2000) (“[T]o establish obviousness . . . there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant.”) (citation omitted)).

For this ground, although Petitioner argues that it is “common knowledge” that the “conventional additives” disclosed in the references “can be used to make tire sealants,” there is no persuasive articulation of a motivation to combine the references in the manner Petitioner suggests, nor of a reasonable expectation of success in the combinations. Pet. 56–57. Petitioner argues generally that one of ordinary skill in the art “would take advantage of the general knowledge in the art that thickening agents and rubber chunks are conventional additives, and that making a tire sealant with such conventional additives is nothing more than an anticipated, obvious, and routine application of known elements” without specifying exactly which materials from which references would be used or how to combine them. Pet. 56 (citing Ex. 1011 ¶ 161–162). We disagree that the mere existence of known ingredients and conventional additives provides motivation to combine those in the manner set forth in the challenged claims, absent persuasive reasons to do so, which we do not find in Petitioner’s argument. In addition to requiring a reason to combine the prior art references, obviousness requires showing that a person of ordinary skill in the art would have had “a reasonable expectation of achieving what is claimed in the patent-at-issue.” *Intelligent Bio-Systems*, 821 F.3d at 1367. The expert testimony on reasonable expectation of success (Ex. 1011 ¶ 163)

points only to the references themselves and no other evidence that the unspecified ingredients or “additives” could be combined or adjusted in the manner specified in the challenged claims with a reasonable expectation of success. *See* 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Rohm & Haas*, 127 F.3d at 1092.

On this complete record, we are unpersuaded by Petitioner’s argument for combining the references and regarding reasonable expectation of success for claims 26, 27, 29, 30, and 32. We address arguments directed to specific claims below.

c. Claim 26

Patent Owner argues that Petitioner provides no motivation to combine regarding “one or more rubber chunks mixed into the agent” in claim 26. PO Resp. 51. Patent Owner also argues that the law requires obviousness theories to be argued with specificity, and therefore, Petitioner’s theory fails because it is unclear from the record which references Petitioner relies on to meet the “rubber chunks” limitation of claim 26. *Id.* at 52.

Petitioner repeats that Haifeng and Wong expressly disclose tire sealants containing the rubber latex of claim 26. Reply 22. Regarding “rubber chunks,” Petitioner also repeats that Haifeng and Wong disclose tire sealants containing all the ingredients of claim 26, and Jaksa points out that tire sealants typically “are viscous fluids, with chunks of natural rubber” which “fill bigger holes.” *Id.* at 23 (citing Ex. 1009, 1:9–15; Ex. 1024 ¶ 102). One of ordinary skill in the art, according to Petitioner, would be motivated to combine Jaksa with Haifeng and Wong to “create a tire sealant

containing conventional ingredients and having increased dispersion characteristics within the tire.” *Id.*

Patent Owner replies that Petitioner’s reply argument with respect to “rubber chunks” merely repeats the Petition. Sur-Reply 23.

As a preliminary matter, “rubber chunks” are one of the three alternative additives in claim 26, which requires a puncture sealing agent “further comprising one of a rubber latex, an adhesive agent and one or more rubber chunks mixed into the agent.” This limitation would be met by rubber latex, or by an adhesive agent, or by rubber chunks. Thus, disclosure of rubber chunks is not necessary.¹⁵

In any event, the deficiencies with respect to Petitioner’s rubber chunks argument are coextensive with the deficiencies with respect to Petitioner’s general motivation to combine and reasonable expectation of success arguments, which we have discussed above. If we assessed Petitioner’s rubber chunks arguments separately from the overall motivation to combine and reasonable expectation of success arguments, we would reach the same conclusion.

d. Claim 29

Regarding claim 29, Patent Owner argues that Petitioner did not prove that Haifeng discloses fibers that form an interlocking network thereby clotting a puncture hole, and that Petitioner’s expert admitted that “fibers will not inherently form an interlocking network.” PO Resp. 55–57 (citing Ex. 2011, 118:22–119:4).

¹⁵ At oral hearing, Petitioner agreed that this was the case, and both parties agreed that no further claim construction type briefing was needed on this issue. Tr. 75:22–76:14, 84:2–85:8.

Regarding the interlocking fibers limitation, Petitioner argues that the “use of such fibers are known to PHOSITA to promote clotting by forming an interlocking network of the fibers.” Reply 23 (citing Ex. 1024 ¶ 104). Petitioner relies on the ’041 patent’s disclosure that small fibers in small concentrations are effective in forming a network of fibers to help clotting. *Id.* at 24 (citing Ex. 1001, 4:6–7, Tables 2–3).

Patent Owner replies that Petitioner’s “inherency” argument regarding Haifeng’s alleged disclosure of an interlocking network of fibers is unsupported. Sur-Reply 24.

Regarding the claim 29 limitation that fibers “form an interlocking network thereby clotting a puncture hole and stopping outbound air passage,” we agree that Petitioner has not shown definitively that Haifeng’s fibers will form the required interlocking network. Patent Owner notes that Petitioner’s expert testified that “it is not possible to know if fibers are touching without knowing the length and concentration of the fibers,” and that fibers that are not touching cannot form an interlocking network. PO Resp. 56 (citing Ex. 2011, 118:22–119:4; Ex. 2010 ¶¶ 111, 114). Petitioner’s counterargument focuses on the disclosures of the ’041 patent itself, rather than any assertions about the relied-upon fibers of Haifeng or Boxi. Reply 24 (citing Ex. 1001). Petitioner has not provided any other compelling evidence that Haifeng’s fibers necessarily form the interlocking network required by claim 29. Ex. 1024 ¶¶ 104, 106 (relying on additional prior art to assert that fibers promote clotting by forming an interlocking

network).¹⁶ The evidence and argument provided by Petitioner, relying on additional references that do not necessarily address the fibers in the relied-upon references, does not meet Petitioner's burden to demonstrate that Haifeng's fibers would inherently have the claimed interlocking network properties.

e. Claim 32

Regarding the disputed limitations of claim 32, Patent Owner argues that (1) "Petitioner cites to no teaching in the prior art for an adhesive that is 1–10% by weight of the sealing agent"; (2) "Petitioner presented no valid motivations to modify Haifeng or Boxi in view of Wong to arrive at the claimed ratios"; and (3) "adjusting the ranges significantly below those disclosed in Haifeng" would "fundamentally change Haifeng's principle of operation." PO Resp. 53–55. Patent Owner argues that Wong and Haifeng are "fundamentally different tire sealants that operate in fundamentally different ways," because Wong's SBR latex is an "additive" and Haifeng's styrene butadiene latex is "the majority of the composition." *Id.* at 54–55 (citing Ex. 2010 ¶ 110). Patent Owner also repeats the argument that Haifeng does not disclose a rubber latex. *Id.* at 55.

Petitioner argues that Wong discloses both 1–10% of rubber latex and 1–10% of adhesive agent, and that one of ordinary skill would have been motivated to combine Wong with the teachings of Haifeng and Jaksa to arrive at a tire sealant containing all the ingredients of claim 32. Reply 24–25 (citing Ex. 1024 ¶ 109). Patent Owner replies that Petitioner has failed to

¹⁶ Whether the fibers necessarily form an interlocking network is a distinct question from the question of whether fibers or fibrous materials enhance sealing capability of a puncture sealing agent, as discussed in, i.e., Ground 1.

establish that Wong's plastic particles are an adhesive, as required by claim 32. Sur-Reply 25.

Regarding the ratio of rubber latex to total weight, we agree that Petitioner's motivation to modify Haifeng's composition to incorporate Wong's ratios is insufficient. Petitioner generally argues that "one skilled in the art would have combined the elements as claimed by known methods with no change in their respective functions, and the combination would yield nothing more than predictable results." Pet. 55–56 (citing Ex. 1011 ¶¶ 161–162). Petitioner relies on Wong to disclose the claimed ratio of rubber latex to total weight. *Id.* at 54. Wong, on its face, discloses rubber latex "about 3% by weight of the total composition." Reply 24; *see also* Pet. 54–55 (citing Ex. 1005, 4:36–43) (Wong's sealant "preferably comprises about 3% by weight of the total composition of a latex fluid, preferably an SBR [styrene butadiene rubber] latex . . ."). Haifeng, however, teaches "styrene butadiene rubber" in a much higher ratio of "20–65%." Ex. 1002, 3 ("adhesive accounts for 20–65% of the total weight"). We also agree with Patent Owner's assessment that Haifeng appears to be referring to making adjustments within its 20–65 wt % range, rather than allowing for a formulation containing as low as 3% by weight of adhesive. PO Resp. 54 (citing Ex. 1002, 3 ("The adhesive accounts for 20–65% of the total weight of the tire sealant, and is formulated into a series of tire sealants according to the region and the type of tire.")). Finally, the rationale for, and perhaps the feasibility of, adjustment of the ratio of rubber latex remains unclear on this complete record. Ex. 2010 ¶ 109.

Our review of Wong and Haifeng, together with the testimony of Patent Owner's declarant, indicates that the relative compositions of Wong

and Haifeng are quite different and do not necessarily lend themselves to simple substitution. *Id.* ¶ 110. We find that the two references operate differently, and one of ordinary skill in the art would not have been motivated to simply swap out one set of parameters for another due to these differences.

f. Claims 27 and 30

We have also reviewed Petitioner's argument and evidence that claims 27 and 30 would have been obvious over Haifeng in view of Wong and Jaksa. Patent Owner does not present separate arguments against Petitioner's challenges to these claims, or repeats the arguments presented against the combination in this ground in general. On this record, we are not persuaded that one of ordinary skill in the art would have been motivated to make the combination proposed by Petitioner, for the reasons stated above.

On this complete record, we are not persuaded that Petitioner has met its burden to demonstrate that claims 26, 27, 29, 30, and 32 would have been obvious to a person of ordinary skill in the art.

*vi. Asserted Obviousness over Boxi in View of Wong and Jaksa
(Ground 6)*

Petitioner argues that claims 26, 29, 30, and 32 would have been obvious to a person of ordinary skill in the art under 35 U.S.C. § 103(a) over Boxi in view of Wong and Jaksa. Pet. 59–66.

For claim 26, Petitioner contends that Boxi discloses a tire sealant composition including a fibrous filler, 5–40% glycerol anti-freeze, carboxymethylcellulose adhesive, and a latex binder. *Id.* at 59–61 (citing Ex. 1003, 3; Ex. 1011 ¶ 167). Petitioner contends that Wong discloses a tire sealant containing a cellulosic thickener such as xanthan gum, glycerine, particulate polymeric component, and an SBR latex. *Id.* (citing Ex. 1005,

1:39–46, 1:48–51, 4:30–35). Petitioner contends Jaksa discloses tire sealants including viscous fluids and chunks of natural rubber. *Id.* at 61 (citing Ex. 1009, 1:9–15).

For claim 29, Petitioner asserts Boxi discloses the use of fibrous fillers that one skilled in the art would have known would “form an interlocking network that promotes clotting and outbound passage of air from a tire.” *Id.* at 62 (citing Ex. 1011 ¶ 170).

For claim 30, Petitioner asserts that Boxi’s use of “nitrates, nitrites and the like” and Wong’s tire sealant containing “conventional additives” such as “a corrosion inhibitor” teach “a corrosion inhibitor mixed into the agent.” *Id.* at 62 (citing Ex. 1003, 2; Ex. 1005, 2:23–25).

For claim 32, Petitioner asserts Wong teaches a ratio of 1–10% rubber latex by weight, because Wong discloses SBR latex in an amount of about 3%. *Id.* at 62–63 (citing Ex. 1005, Abstract, 4:36–43). Petitioner asserts that Wong teaches a ratio of 1–10% adhesive agent by weight, because Wong teaches about 3% to about 6% by weight particulate polymeric component. *Id.* at 63 (citing Ex. 1005, 41:40–46, 5:1–6).

Petitioner contends that one skilled in the art “would have combined the elements as claimed by known methods with no change in their respective functions, and the combination would yield nothing more than predictable results to one of ordinary skill in the art.” *Id.* at 64 (citing Ex. 1011 ¶¶ 174–175). Petitioner contends “[s]uch a combination would not require any changes in the function of Boxi’s, Wong’s, or Jaksa’s materials, and the combination would yield nothing more than predictable results.” *Id.* at 65–66 (citing Ex. 1011 ¶¶ 175).

Patent Owner generally advances the same arguments presented against Haifeng in combination with Wong and Jaksa in Ground 5. PO Resp. 51–57.

As noted above, we are unpersuaded by Petitioner’s motivations to combine Haifeng and Wong; we have the same reservations about Petitioner’s motivations to combine Boxi and Wong, which are largely coextensive. *Compare* Pet. 55–58 *with* Pet. 64–66.

We have addressed the rubber latex argument above, and determined that, based on the complete record now before us, Boxi is inconclusive about disclosure of a rubber latex. *See supra*. Therefore, Petitioner’s proposed combination of Boxi’s “latex” with the elements of the remaining references again falls short.

Regarding the rubber chunks limitation of independent claim 26, we have the same concerns about Petitioner’s Jaksa-based arguments as expressed above. In sum, to the extent rubber chunks are required at all, we are presented with no compelling reason to incorporate Jaksa’s rubber chunks into the tire sealant of Boxi and Wong.

Regarding the interlocking fibers limitation of claim 29, we have the same concerns about Petitioner’s Boxi-based arguments as with Petitioner’s Haifeng-based arguments. Patent Owner provides evidence that “it is not possible to know if fibers are touching without knowing the length and concentration of the fibers,” and that fibers that are not touching cannot form an interlocking network. PO Resp. 56 (citing Ex. 2011, 118:22–119:4; Ex. 2010 ¶¶ 111, 114). The evidence and argument provided by Petitioner, relying on additional references that do not necessarily address the fibers in the relied-upon references, does not meet Petitioner’s burden to demonstrate

that Boxi's fibers would inherently have the claimed interlocking network properties.

Regarding the ratios limitations of claim 32, we have similar concerns about Petitioner's Wong-based arguments as expressed above. Moreover, we are not persuaded that Boxi discloses a rubber latex, and thus, that any combination with Wong's SBR latex would be possible. In sum, we are presented with no compelling reason to modify Boxi's ratios according to the teachings of Wong.

We have also reviewed Petitioner's argument and evidence that claim 30 would have been obvious over Boxi in view of Wong and Jaksa. Patent Owner does not present separate arguments against Petitioner's challenges to claim 30, or repeats the arguments presented against the combination of Haifeng with Wong or Jaksa. On this complete record, we are not persuaded that one of ordinary skill in the art would have been motivated to make the combination of Boxi, Wong, and Jaksa.

IV. CONCLUSION¹⁷

For the reasons discussed above, we determine Petitioner has proven, by a preponderance of the evidence, that certain challenged claims are unpatentable, as summarized in the following table:

¹⁷ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

Claims	35 U.S.C. §	References/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–4, 9, 17, 20	102(b)	Haifeng	1–4, 9, 17, 20	
1–4, 9, 17, 20	103(a)	Haifeng, Boxi		1–4, 9, 17, 20
1–5, 9, 17, 20	103(a)	Haifeng, Kishida, Guihe		1–5, 9, 17, 20
1–4, 9, 17, 20	103(a)	Boxi, Kishida		1–4, 9, 17, 20
26, 27, 29, 30, 32	103(a)	Haifeng, Wong, Jaksa		26, 27, 29, 30, 32
26, 29, 30, 32	103(a)	Boxi, Wong, Jaksa		26, 29, 30, 32
Overall Outcome			1–4, 9, 17, 20	5, 26, 27, 29, 30, 32

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 1–4, 9, 17, and 20 of U.S. Patent No. 7,388,041 B2 are unpatentable;

FURTHER ORDERED that Petitioner does not establish, by a preponderance of the evidence, that claims 5, 26, 27, 29, 30, and 32 of U.S. Patent No. 7,388,041 B2 are unpatentable; and

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

IPR2019-01202
Patent 7,388,041 B2

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