

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REACTIVE SURFACES LTD., LLP,
Petitioner,

v.

TOYOTA MOTOR CORPORATION,
Patent Owner.

Case IPR2016-01914
Patent 8,394,618 B2

Before CHRISTOPHER M. KAISER, JEFFREY W. ABRAHAM, and
MICHELLE N. ANKENBRAND, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

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

INTRODUCTION

A. Background

Reactive Surfaces Ltd., LLP (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–11 of U.S. Patent No. 8,394,618 B2 (Ex. 1001, “the ’618 patent”). On March 23, 2017, we instituted trial to review the patentability of claims 1–11. Paper 26 (“Inst. Dec.”).

On March 3, 2017, Toyota Motor Corporation and the Regents of the University of Minnesota, the joint owners of the ’618 patent, filed a motion to dismiss this proceeding on the ground of sovereign immunity under the Eleventh Amendment to the United States Constitution. Paper 23. Following a Response to the Motion to Dismiss by Petitioner (Paper 25) and a Reply (Paper 28), we granted the motion to dismiss in part, dismissing the Regents of the University of Minnesota from the proceeding, but continuing to review the patentability of the claims of the ’618 patent with Toyota Motor Corporation present as Patent Owner. Paper 36.

After our decision on the Motion to Dismiss, Patent Owner filed a Response (Paper 37, “PO Resp.”), Petitioner filed a Reply (Paper 41), and Patent Owner filed a Sur-Reply (Paper 56). Patent Owner filed Observations on Cross-Examination (Paper 54), to which Petitioner filed a Response (Paper 57). We held an oral hearing on January 9, 2018. Paper 63 (“Tr.”). After the oral hearing, we authorized both parties to file additional briefing regarding the proper application of the Board’s precedential decision in *Ex parte Schulhauser* to the challenged claims. Paper 60. Petitioner and Patent Owner each filed an additional brief on this issue. Paper 61; Paper 62.

We have jurisdiction under 35 U.S.C. § 6, and we issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We conclude that Petitioner has established by a preponderance of the evidence that claims 1–11 of the '618 patent are unpatentable.

B. Related Matters

The parties have not identified any judicial or administrative matters that involve the '618 patent or that are otherwise related to this case.¹ Pet. 1; Paper 4, 1.

C. The Instituted Grounds of Unpatentability

We instituted review of claims 1–11 of the '618 patent based on the following grounds:

Statutory Ground	Basis	Challenged Claim(s)
§ 103	Van Antwerp ²	1–3
§ 103	Van Antwerp and Bostek ³	4 and 5
§ 103	Van Antwerp and Moon ⁴	6–9

¹ The parties note that the '618 patent was the subject of *Reactive Surfaces Ltd. LLP v. Toyota Motor Engineering & Manufacturing North America, Inc.*, Case No. 1-13-CV-1098-LY (W.D. Tex.), and *Reactive Surfaces Ltd. LLP v. Toyota Motor Corporation*, Case No. 1:14-CV-1009-LY (W.D. Tex.), both of which have been dismissed without prejudice. Pet. 1–2; Paper 4, 1.

² Van Antwerp, U.S. Patent No. 5,868,720, issued Feb. 9, 1999 (Ex. 1005, “Van Antwerp”).

³ C. Carl Bostek, *Effective Methods of In-Line Intravenous Fluid Warming at Low to Moderate Infusion Rates*, 60 J. AM. ASS’N NURSE ANESTHETISTS 561, 561–66 (Dec. 1992) (Ex. 1009, “Bostek”).

⁴ Moon et al., US 2005/0176905 A1, published Aug. 11, 2005 (Ex. 1006, “Moon”).

Statutory Ground	Basis	Challenged Claim(s)
§ 103	Van Antwerp and Hamade ⁵	10 and 11
§ 103	Schneider ⁶	1–8, 10, and 11
§ 103	Schneider and McDaniel ⁷	9
§ 103	Drevon ⁸	1–9
§ 103	Drevon and Schneider	10 and 11

D. The '618 Patent

The '618 patent is directed to a “substrate or coating . . . that includes a lipase with enzymatic activity toward a component of a fingerprint” and “a process for facilitating the removal of fingerprints . . . wherein an inventive substrate or coating including a lipase is capable of enzymatically degrading . . . one or more components of the fingerprint to facilitate fingerprint removal from the substrate or said coating.” Ex. 1001, at [57]. “Fingerprint” is defined in the '618 patent as “a bioorganic stain, mark, or residue left behind after an organism touches a substrate or coating,” and it “is not limited to marks or residue left behind after a substrate is touched by a finger.” *Id.* at 3:1–4. “Other sources of bioorganic stains are illustratively, palms, toes, feet, face, any other skin surface area, hair, stains from fats used in cooking such as cis-fatty acids, or fatty acids from any other source.” *Id.* at 3:4–8.

⁵ Hamade et al., U.S. Patent No. 6,150,146, issued Nov. 21, 2000 (Ex. 1007, “Hamade”).

⁶ Schneider et al., US 2005/0147579 A1, published July 7, 2005 (Ex. 1004, “Schneider”).

⁷ McDaniel, US 2004/0109853 A1, published June 10, 2004 (Ex. 1008, “McDaniel”).

⁸ Géraldine F. Drevon, *Enzyme Immobilization into Polymers and Coatings* (Ph.D. Thesis, University of Pittsburgh, Nov. 2002) (Ex. 1003, “Drevon”).

E. Illustrative Claim

Petitioner challenges all the claims of the '618 patent. Claim 1 is independent and illustrative; it recites:

1. A method of facilitating the removal of a fingerprint on a substrate or a coating comprising:
providing a substrate or a coating;
associating a lipase with said substrate or said coating such that said lipase is capable of enzymatically degrading a component of a fingerprint, and
facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint.

Id. at 15:18–27.

ANALYSIS

A. Claim Construction

In an *inter partes* review, we construe claim terms in an unexpired patent according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144 (2016) (upholding the use of the broadest reasonable interpretation standard). Claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Petitioner proposes constructions for four terms: “fingerprint,” “latent fingerprint,” “vaporization,” and “facilitating the removal of a fingerprint by vaporization.” Pet. 16–17, 22; Reply 2–3. Patent Owner does not propose construing any terms, but it does agree with the interpretation of

“facilitating the removal of a fingerprint by vaporization” that we adopted in our Institution Decision. PO Resp. 13–14; Paper 56.

1. “*Fingerprint*”

Petitioner argues that the ’618 patent expressly defines the term “fingerprint.” Pet. 16–17 (quoting Ex. 1001, 3:1–9). We agree. An inventor may define specific terms used to describe an invention, but must do so “with reasonable clarity, deliberateness, and precision” and must “‘set out his uncommon definition in some manner within the patent disclosure’ so as to give one of ordinary skill in the art notice of the change” in meaning. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (quoting *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1387–88 (Fed. Cir. 1992)). The ’618 patent states that “[a] fingerprint as defined herein is a bioorganic stain, mark, or residue left behind after an organism touches a substrate or coating.” Ex. 1001, 3:1–3. Moreover, the touch by an organism need not be by the organism’s finger; the ’618 patent lists “palms, toes, feet, face, any other skin surface area, hair, stains from fats used in cooking such as cis-fatty acids, or fatty acids from any other source” as “[o]ther sources of bioorganic stains.” *Id.* at 3:3–9. The language of the ’618 patent begins with “[a] fingerprint as defined herein is” We find that this sets out a definition of the term “fingerprint” with “reasonable clarity, deliberateness, and precision.” *Paulsen*, 30 F.3d at 1480. Accordingly, we interpret “fingerprint” as “a bioorganic stain, mark, or residue left behind after an organism touches a substrate or coating” that is not limited to marks produced by an organism touching a substrate or coating with a finger.

2. “*Latent Fingerprint*”

Petitioner proposes construing the term “latent fingerprint.” Reply 2. This term does not appear in any claim, and construing it is not necessary to resolve the parties’ dispute over the patentability of claims 1–11. Accordingly, we do not construe “latent fingerprint.” See *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”).

3. “*Vaporization*”

Petitioner proposes construing the term “vaporization,” although Petitioner does not provide a bounded construction of the term. Reply 3. Instead, Petitioner argues only that “vaporization” is broad enough to “include[] evaporation.” *Id.* Because neither party addresses the precise construction of “vaporization,” and because determining that precise construction is not necessary to resolve the parties’ dispute over the patentability of claims 1–11, we do not construe “vaporization” expressly. See *Vivid Techs.*, 200 F.3d at 803.

4. “*Facilitating the Removal of a Fingerprint by Vaporization*”

In our Institution Decision, we construed “facilitating the removal of a fingerprint by vaporization” as “enabling a bioorganic material deposited by an organism through touching a surface to transition, by vaporization of the bioorganic material, from an initial quantity of visually apparent bioorganic material being on such substrate or coating to a lesser quantity of visually apparent bioorganic material being thereon.” Inst. Dec. 5–6. Patent Owner argues that we should continue to use that interpretation. PO Resp. 13–14 n.2. Although Petitioner argues in the Petition that “facilitating the removal

of a fingerprint by vaporization” should be interpreted as “enabling a bioorganic material deposited by an organism through touching a lipase associated substrate or coating to transition from an initial quantity of visually apparent bioorganic material being on such substrate or coating to a lesser quantity of visually apparent bioorganic material being thereon,” Pet. 8–22, we noted in the Institution Decision that Petitioner did not explain sufficiently why a person of ordinary skill in the art would interpret “facilitating the removal of a fingerprint by vaporization” in a way that did not require the removal to involve vaporization. Inst. Dec. 5–6. Petitioner does not address this issue in the Reply. Reply 1–3. Accordingly, we maintain the construction we adopted in the Institution Decision, and we interpret “facilitating the removal of a fingerprint by vaporization” as “enabling a bioorganic material deposited by an organism through touching a surface to transition, by vaporization of the bioorganic material, from an initial quantity of visually apparent bioorganic material being on such substrate or coating to a lesser quantity of visually apparent bioorganic material being thereon.”

B. Asserted Obviousness on Grounds Relating to Van Antwerp

We instituted trial to determine whether the subject matter of claims 1–3 would have been obvious to a person of ordinary skill in the art given the teachings of Van Antwerp. Inst. Dec. 6–9, 30; see Pet. 36–39. In addition, we instituted trial to determine whether the subject matter of the following claims would have been obvious to a person of ordinary skill in the art given the teachings of the following prior art references: claims 4 and 5 over the combination of Van Antwerp and Bostek; claims 6–9 over the combination of Van Antwerp and Moon; and claims 10 and 11 over the

combination of Van Antwerp and Hamade. Inst. Dec. 9–15, 30; see Pet. 39–45.

1. Van Antwerp

Van Antwerp relates to “[a]n improved indwelling catheter adapted for long-term usage [that] includes a stable enzyme coating to prevent occlusion of the catheter lumen.” Ex. 1005, at [57]. The catheter of Van Antwerp “includes a stable and substantially immobilized enzyme coating to prevent formation of and/or to dissolve occlusions along the catheter lumen,” and the enzyme is disclosed as “fibrinolytic and/or lipolytic.” *Id.* at 2:34–40. The catheter itself “is commonly constructed from a polymeric material, such as medical grade silicone rubber, polyethylene, or the like.” *Id.* at 3:65–67. The lipolytic enzyme of the catheter coating “combines with grease or soap-like phospholipids produced in the presence of body fluids and certain medications, to produce soluble lipase compounds,” which causes the occlusion to be dissolved. *Id.* at 6:14–24.

2. Bostek

Bostek relates to warming intravenous fluids during the administration of those fluids to patients. Ex. 1009, 561. Bostek discloses warming a bag of intravenous fluids to increase the temperature of the fluids being infused to 25 degrees Celsius or higher at the site of the infusion catheter. *Id.* at 564–65.

3. Moon

Moon “relates to a monomer with anti-microbial characteristics, a polymeric compound with anti-microbial characteristics using the same, and manufacturing methods thereof.” Ex. 1006, at [57]. Moon discloses a

“polymeric resin composition” that is “particularly useful for medical supplies . . . such as catheters.” *Id.* ¶ 59.

4. *Hamade*

Hamade relates to “[a] novel method for controlled release of compounds having antimicrobial activity and a novel coating composition capable of controlled release of compounds having antimicrobial activity.” Ex. 1007, at [57]. Hamade discloses producing a “compound having antimicrobial activity . . . by enzymatic reaction between an enzyme and a substrate.” *Id.* at 3:29–31. The enzymes used in Hamade include an esterase, such as triacylglycerol lipase and lipoprotein lipase. *Id.* at 4:5–15.

5. *Analysis*

a. The “Facilitating the Removal of a Fingerprint by Vaporization” Limitation

As noted above, claim 1, the only independent claim of the ’618 patent, recites a preamble and three limitations: “[a] method of facilitating the removal of a fingerprint on a substrate or a coating,” “providing a substrate or a coating,” “associating a lipase with said substrate or said coating such that said lipase is capable of enzymatically degrading a component of a fingerprint,” and “facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint.” Ex. 1001, 15:18–27. In each of the Van Antwerp grounds, Petitioner relies on Van Antwerp to teach or suggest the limitations of claim 1, except for “facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint.” Pet. 36–38. Petitioner argues that this limitation is

inherent in the performance of the method steps that Van Antwerp teaches or suggests. *Id.* at 38; Reply 3–10.

We agree that Van Antwerp itself does not expressly teach or suggest “facilitating the removal of a fingerprint by vaporization” (the “facilitating step”). Ex. 1005, 4:8–26, 6:14–18, Fig. 4 (teaching only using the lipolytic enzyme to facilitate dissolving bioorganic material from the surface of the catheter into the liquid-phase environment). As we explain below, however, we are persuaded that Van Antwerp’s failure to teach or suggest this limitation does not affect the obviousness of the challenged claims. Before turning to Van Antwerp, we address whether the facilitating step is a conditional method step.

*(1) Is the Facilitating Step a Conditional Method
Step That the Prior Art Need Not Teach or
Suggest?*

When a claim recites a method step that is conditioned on the occurrence of some event, the broadest reasonable interpretation of the scope of that claim may encompass two separate methods: one in which the conditional step occurs and one in which the conditional step does not occur. *Ex parte Schulhauser*, No. 2013-007847, 2016 WL 6277792, at *4–5 (PTAB Apr. 28, 2016) (precedential) (applying rule to claim having separate, mutually exclusive conditional method steps); *see Ex parte Urbanet*, No. 2011-002606, 2012 WL 4460637, at *2 (PTAB Sep. 19, 2012) (applying rule to claim having single conditional method step); *see also Cybersettle, Inc. v. Nat’l Arbitration Forum, Inc.*, 243 Fed. Appx. 603, 607 (Fed. Cir. 2007) (unpublished) (“It is of course true that method steps may be contingent. If the condition for performing a contingent step is not

satisfied, the performance recited by the step need not be carried out in order for the claimed method to be performed.”).

Because neither party briefed this issue before the oral hearing, we invited each party to submit a brief presenting argument as to whether the facilitating step is conditional and therefore non-limiting under *Schulhauser*. Paper 60. Petitioner argues that, under *Schulhauser*, the facilitating step is conditional and need not be carried out to practice the claimed method. Paper 62, 2–5. Instead, according to Petitioner, the claimed method encompasses a method where the first two steps are performed and the facilitating step never occurs because the surface or coating is never contacted by a fingerprint. *Id.* at 3. Patent Owner argues that the claim language “when contacted by a fingerprint” does not make the facilitating step conditional on a fingerprint contacting the surface. Paper 61, 3–4. Instead, Patent Owner argues that this language provides a temporal limitation: the facilitating step must occur after the fingerprint contacts the surface. *Id.* Thus, according to Patent Owner, the claimed method does not encompass a method with only the first two steps performed; instead, a fingerprint contacting the surface is a necessary part of the claim. *Id.*

Although we disagree with Patent Owner that the language “when contacted by a fingerprint” is purely temporal, we agree that the challenged claims should not be interpreted in such a way as to encompass methods in which the facilitating step does not occur. The facilitating step itself is conditional, rather than temporally limited, because it occurs only when the surface from which the fingerprint is to be removed is “contacted by a fingerprint.” Ex. 1001, 15:24–26 (emphasis added). The use of “when” instead of “if” does not change whether the method step is conditional. *Ex*

parte Kaundinya, No. 2016-000917, 2017 WL 5510012, at *6 (PTAB Nov. 14, 2017) (“when” may indicate a conditional method step); *Ex parte Zhou*, No. 2016-004913, 2017 WL 5171533, at *2 (PTAB Nov. 1, 2017) (same); *Ex parte Lee*, No. 2014-009364, 2017 WL 1101681, at *2 (PTAB Mar. 16, 2017) (same). In other words, “when contacted by a fingerprint” could be replaced by “if contacted by a fingerprint” without changing the meaning of the claims. The alternative would be to interpret “when contacted by a fingerprint” as a solely temporal limitation requiring the facilitation of removal to take place after the fingerprint is placed on the surface. This alternative view would be persuasive if there were no way to carry out the other method steps without a fingerprint being present. For example, if, in addition to the limitations that are already present, claim 1 also recited “placing a fingerprint on the lipase associated substrate or coating,” it would make sense to interpret “when contacted by a fingerprint” as merely limiting the time during which the facilitation of removal could occur. Without such a limitation, however, a fingerprint may or may not ever make contact with the lipase associated surface, so the interpretation of “when contacted by a fingerprint” as conditional is more compelling.

This does not end our inquiry, however, because we must consider the facilitating step within the context of claim 1 as a whole. Claim 1’s preamble recites “[a] method of facilitating the removal of a fingerprint on a substrate or a coating.” Ex. 1001, 15:18–19. When the facilitating step does not occur (i.e., when the surface is not “contacted by a fingerprint”), the method is no longer the “method of facilitating the removal of a fingerprint” that the preamble requires. The applicant emphasized the recitation of a “method of facilitating the removal of a fingerprint” in the preamble and the

use of the lipase-associated substrate or coating to facilitate the removal of a fingerprint in the final method step when arguing for the patentability of the challenged claims during prosecution of the '618 patent. Ex. 1012, 9–10. Because of this reliance on the language of the preamble and the facilitating step, we conclude that a person of ordinary skill in the art would not interpret the challenged claims as encompassing a method in which the facilitating step was not performed and no fingerprint removal was facilitated. See *Catalina Mktg. Int'l v. Coolsavings.com, Inc.*, 289 F.3d 801, 808–09 (Fed. Cir. 2002) (“[C]lear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.”). Thus, we decline to interpret claim 1 in such a way that it encompasses a method in which only the first two limitations are performed. Accordingly, Petitioner must show that the entire claimed method, including the “facilitating the removal of a fingerprint by vaporization” limitation, would have been obvious.⁹

⁹ Even assuming that a person of ordinary skill in the art would interpret the challenged claims as encompassing a method in which the facilitating step was not performed, *Schulhauser* requires Petitioner only to show that the prior art teaches or suggests performing the first two method steps. Showing that the prior art teaches or suggests performing all three steps necessarily includes a showing that the first two steps are performed. As discussed below, Petitioner has made such a showing. Accordingly, even if *Schulhauser* applies here, Petitioner still has shown the obviousness of the challenged claims.

*(2) Is Performance of the Facilitating Step Inherent
in the Performance of the Other Method Steps?*

Petitioner argues that “facilitating the removal of a fingerprint by vaporization” is inherent in the performance of the method steps that Van Antwerp teaches or suggests. Pet. 38; Reply 3–10. Petitioner supports this argument with Dr. Rozzell’s testimony that it was “well-known” that “[l]ipases will degrade triglycerides and other lipids, wax esters, other fatty acid esters, cholesterol esters, and similar compounds, which are well-known to be among the components of fingerprints” and that “it would be an inherent property that a lipase immobilized on a surface would degrade a triglyceride-base oil stain.” Ex. 1010 ¶¶ 35–36. Dr. Rozzell also testifies that the breakdown products of the catalytic activity of lipase on the compounds present in fingerprints are “more readily vaporizable” and would “disappear more quickly” from a surface. *Id.* ¶¶ 40–41. Dr. Rozzell supports his testimony by citing to Buchanan,¹⁰ an article from the forensic science literature. *Id.* ¶¶ 35–36, 40–41 (citing Ex. 1013, 89–91). Buchanan reports that “the fingerprints of children disappear from surfaces more quickly than those of adults” and describes a study intended to determine the reason for this phenomenon. Ex. 1013, 89. The study found that samples extracted from adult fingertips contained “higher concentrations of less volatile long chain esters of fatty acids,” whereas samples extracted from children’s fingertips “contained higher levels of relatively volatile free fatty acids.” *Id.* Because the free fatty acids in children’s fingerprints would

¹⁰ Michelle V. Buchanan, Keiji Asano, & Arthur Bohanon, *Chemical Characterization of Fingerprints from Adults and Children*, in FORENSIC EVIDENCE ANALYSIS & CRIME SCENE INVESTIGATION, 2941 PROC. SPIE 89 (Feb. 5, 1997) (Ex. 1013, “Buchanan”).

evaporate more quickly from a surface than would the long-chain esters of fatty acids in adult fingerprints, Buchanan concludes that this difference in composition accounts for the more rapid disappearance of children's fingerprints from surfaces. *Id.* at 89, 91.

Patent Owner does not present any evidence to the contrary but argues that Dr. Rozzell's testimony is conclusory because it relies only on Buchanan, which Petitioner has not shown to be a printed publication that a person of ordinary skill in the relevant art reasonably could have located. We do not find this argument persuasive. It is clear that Buchanan was published in the sense that it was available to those with an interest in finding it. Buchanan appeared as an article in the *Proceedings of SPIE*, the journal of the Society of Photo-Optical Instrumentation Engineers, in February 1997. Ex. 1023 ¶¶ 1, 2, 6. The journal issue was cataloged at the Library of Congress. *Id.* at Attachment A, 12. Others working in the field of forensic science cited Buchanan in prior-art articles. Ex. 1021, 316 n.4; Ex. 1022, 6 n.2. It also appeared in the international search report accompanying a 2006 patent application relating "to a method for determining the presence of a residue on or within a fingerprint using mass spectrometric techniques." Ex. 1031, 1, 63.

Despite the general public availability of Buchanan, Patent Owner argues that it may not have been available specifically to those of ordinary skill in the art relevant to the '618 patent. PO Resp. 27–35. As discussed above, Buchanan was published in a forensic science journal, and the prior-art citations to Buchanan come from researchers in forensic science. Patent Owner argues that the '618 patent is in the art of "bioactive coatings," which is not the same as, or closely related to, forensic science. *Id.* at 28. We do

not find this argument persuasive. First, Patent Owner's definition of the relevant field is far too narrow. The claims of the '618 patent are not limited to coatings at all, much less to only bioactive coatings. Ex. 1001, 15:18–27 (claim 1, reciting a method with a first step of “providing a substrate or a coating”).

Second, even if we agreed with Patent Owner that Buchanan were outside the field of the invention of the '618 patent, a prior-art reference need not fall within the field of the invention for a person of ordinary skill in the art to consider it. Instead, the reference must have “been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it.” *Bruckelmyer v. Ground Heaters, Inc.*, 445 F.3d 1374, 1378 (Fed. Cir. 2006). The reference to “the subject matter or art” is telling, because it references the test for analogous art, which permits the consideration of prior art that “is either in the field of the applicant's endeavor or is reasonably pertinent to the problem with which the inventor was concerned.” *In re Kahn*, 441 F.3d 977, 986–87 (Fed. Cir. 2006). Thus, a prior-art reference is both analogous art and, assuming sufficient dissemination, a printed publication, even if it falls outside the field of the invention, if it “is reasonably pertinent to the problem with which the inventor was concerned.” *Id.*

Here, the problem solved by the '618 patent is not the creation of a bioactive surface or surface treatment in isolation, but rather the development of “materials or coatings that can actively promote the removal of fingerprints on organic surfaces or in organic coatings.” Ex. 1001, 1:40–42; see Ex. 1001, 15:18–27 (reciting “[a] method of facilitating the removal

of a fingerprint . . .”). It is difficult to imagine a reference more relevant to the problem of removing fingerprints from a surface or coating than Buchanan, which relates to the “[c]hemical characterization of fingerprints.” Ex. 1013, 89. A natural starting point for someone seeking to develop “materials or coatings that can actively promote the removal of fingerprints” would be to determine the substances of which fingerprints are composed. Accordingly, Buchanan is at least “reasonably pertinent to the problem with which the inventor was concerned,” so it is analogous art to the ’618 patent. Because Buchanan is analogous art, and because, as discussed above, it was disseminated sufficiently to enable those interested in its subject matter to locate it, we find that a person of ordinary skill in the art attempting to solve the problem solved by the ’618 patent would have been aware of its contents.

The next question is whether Buchanan supports Dr. Rozzell’s testimony that “triglycerides and other lipids, wax esters, other fatty acid esters, cholesterol esters, and similar compounds . . . are well-known to be among the components of fingerprints.” Ex. 1010 ¶ 35. It does. The “chemical compositions of fingerprints” of adults “were found to have higher concentrations of less volatile long chain esters of fatty acids,” and those of children “contained higher levels of relatively volatile free fatty acids.” Ex. 1013, 89. Samples tested in Buchanan contained lipids, and Buchanan states that “this material . . . can be found in fingerprints.” *Id.* at 90. Buchanan discusses the presence of lipids in the fingerprints of both children and adults, though in “far lower levels” in children’s fingerprints. *Id.* at 90–91. In addition, “[c]holesterol was observed in all samples studied” in Buchanan. *Id.* at 91. Additional evidence of record further

supports Dr. Rozzell's testimony regarding the components of fingerprints. *See, e.g.*, Ex. 1001, 2:38–40 (“Fingerprint stains typically include . . . lipids, wax, and cellular debris.”); Ex. 1017, 82:18–20 (fingerprints contain lipids). Accordingly, we credit Dr. Rozzell's testimony and find that a person of ordinary skill in the art would have known that fingerprint stains contained “triglycerides and other lipids, wax esters, other fatty acid esters, cholesterol esters, and similar compounds.” Ex. 1010 ¶ 35.

Dr. Rozzell also testifies that lipases would degrade these components of fingerprints. *Id.* (citing Ex. 1010, Attachment E (reproduced as Ex. 1019)). There is evidence of record to support this testimony. Ex. 1001, 2:43–47 (lipids include triacylglycerol); Ex. 1019, 234 (triacylglycerol lipase degrades triacylglycerol to “diacylglycerol” and “a fatty acid anion”); *see* Ex. 1017, 82:3–13 (“it was well known that a lipase would degrade a lipid,” and this has been known since the “early 1900s”). Accordingly, we credit Dr. Rozzell's testimony and find that a person of ordinary skill in the art would have known that a lipase would degrade lipids.

Finally, Dr. Rozzell testifies that fingerprints with lower concentrations of low-volatility components would disappear more quickly via vaporization than fingerprints with higher concentrations of those same components, as well as that the action of lipases on fingerprint lipids would cause low-volatility components to break down into smaller, higher-volatility components. There is evidence of record to support this testimony. Ex. 1013, 91 (“the lower molecular weight, volatile carboxylic acids . . . would tend to evaporate from the surface,” but “the alkyl esters . . . would remain on the surface longer”); Ex. 1019, 234 (triacylglycerol lipase degrades triacylglycerol to “diacylglycerol” and “a fatty acid anion”).

Accordingly, we credit Dr. Rozzell's testimony and find that a person of ordinary skill in the art would have known that the breakdown products of lipase action on lipids would be lower molecular weight and higher volatility components that would tend to evaporate from surfaces more quickly.

In sum, if a lipase were associated with a surface in such a way as to maintain its catalytic activity on lipids, the evidence in this case shows that (1) the lipase would break down lipids placed on the surface into lower molecular weight and higher volatility components; (2) those breakdown products would evaporate more quickly than would the original higher molecular weight and lower volatility lipids; and (3) that fingerprints contain lipids. Therefore, if a surface-associated lipase is capable of degrading lipids, it inherently will facilitate the removal of lipid-containing stains, such as fingerprints, by vaporization from the surface. The association of a lipase with a surface in such a way as to maintain its catalytic activity on lipids is precisely what the first two method steps of the challenged claims require. Ex. 1001, 15:20–23 (“providing a substrate or a coating” and “associating a lipase with said substrate or coating such that said lipase is capable of enzymatically degrading a component of a fingerprint”). Accordingly, we find that any combination of prior art that teaches the first two limitations of the challenged claims inherently would teach the step of “facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint.”

b. Claim 1

In each of the Van Antwerp grounds, Petitioner relies on Van Antwerp to teach or suggest the limitations of claim 1, except for “facilitating the removal of a fingerprint by vaporization from the lipase

associated substrate or coating when contacted by a fingerprint,” which we discuss above. Pet. 36–38. Patent Owner does not oppose the argument that Van Antwerp teaches or suggests “providing a substrate or a coating” and “associating a lipase with said substrate or . . . coating such that said lipase is capable of enzymatically degrading a component of a fingerprint.” PO Resp. 8–9, 11–49. We agree with both parties that Van Antwerp teaches or suggests these two limitations. Ex. 1005, 2:34–42, 3:41–44, 3:65–67, 4:8–26, 6:14–18, Fig. 4 (teaching an “indwelling catheter” with a lipolytic “enzyme coating” that reacts with “grease or soap-like phospholipids” to remove “lipid-based” occlusions from the surface of the coating); Ex. 1010 ¶ 35 (lipids “are well-known to be among the components of fingerprints”); Ex. 1013, 90–91 (chemical analysis of materials extracted from fingertips using rubbing alcohol contained lipid compounds); Ex. 1017, 55:25–56:17 (Van Antwerp’s enzyme “probably” would degrade a fingerprint on the surface of Van Antwerp’s catheter). Accordingly, Petitioner has shown that Van Antwerp teaches the first two method steps of claim 1. As discussed above, the third step would occur inherently once the first two steps were performed. Accordingly, Petitioner has proven by a preponderance of the evidence that claim 1 would have been obvious over Van Antwerp.

c. Claim 2

Claim 2 of the ’618 patent depends from claim 1 and adds a limitation requiring that the lipase be “covalently attached to [the] substrate or [the] coating.” Ex. 1001, 15:28–29. Petitioner argues that Van Antwerp teaches or suggests this limitation. Pet. 38 (citing Ex. 1005, 5:29–43, 5:59–6:9). Van Antwerp discloses “chemically bond[ing]” enzyme-containing capsules to a catheter “by silicone chemistry,” where at least some of the bonds are

covalent. Ex. 1005, 5:29–43, 5:59–6:9. Patent Owner does not dispute this teaching. Accordingly, we find that Van Antwerp teaches or suggests attaching the lipase to the surface using covalent bonding, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 2 would have been obvious over Van Antwerp.

d. Claim 3

Claim 3 depends from claim 1 and requires that the lipase be “non-covalently adhered to or admixed into [the] substrate or [the] coating.” Ex. 1001, 15:30–32. Petitioner argues that Van Antwerp teaches or suggests this limitation. Pet. 38–39 (citing Ex. 1005, 2:46–50, 4:36–47). Van Antwerp discloses applying the enzyme to the catheter “as a thin micellar coating.” Ex. 1005, 2:46–50. This coating adheres to the catheter “in a micellar array of microsphere particles.” *Id.* at 4:36–47. Patent Owner does not dispute this teaching. Accordingly, we find that Van Antwerp teaches attaching the lipase to the surface using non-covalent bonding, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 3 would have been obvious over Van Antwerp.

e. Claim 4

Claim 4 depends from claim 1 and adds a limitation requiring “heating [the] substrate or [the] coating or applying heat to a surface of said substrate or said coating subsequent to being contacted by a fingerprint.” Ex. 1001, 15:33–35. Petitioner argues that Bostek teaches or suggests this limitation. Pet. 39–40 (citing Ex. 1009, 564–65). Bostek discloses heating intravenous fluid before it is infused into a patient, and Bostek teaches that this heating causes the temperature of the fluid passing through the catheter to rise, which would cause the catheter and its coating to be warmed. Ex.

1009, 564–65. Patent Owner does not dispute this teaching. Accordingly, we find that Bostek teaches heating a substrate or coating.

In addition, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine the teachings of Bostek with those of Van Antwerp because Bostek provides specific examples of using a catheter, such as the catheter described in Van Antwerp, to administer fluids to a patient. Pet. 40. Applying Bostek’s heating and infusing process to Van Antwerp’s catheter is no more than the combination of prior-art elements according to known methods to yield predictable results. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Moreover, Patent Owner does not dispute that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Antwerp and Bostek. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 4 would have been obvious over the combination of Van Antwerp and Bostek.

f. Claim 5

Claim 5 depends from claim 4 and adds a limitation requiring that the heating take place “for at least 30 minutes.” Ex. 1001, 15:36–37. Petitioner argues that Bostek teaches or suggests this limitation. Pet. 40 (citing Ex. 1009, 564–65). Bostek discloses infusing heated intravenous solution for up to two hours. Ex. 1009, 564. Patent Owner does not dispute this teaching. Accordingly, we find that Bostek teaches heating the substrate or coating for at least 30 minutes, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 5 would have been obvious over the combination of Van Antwerp and Bostek.

g. Claim 6

Claim 6 depends from claim 1 and adds a limitation requiring that the substrate or coating “comprise[] an organic crosslinkable polymer resin.” Ex. 1001, 16:17–18. Petitioner argues that Van Antwerp teaches or suggests this limitation.¹¹ Pet. 40 (citing Ex. 1005, 3:65–67). Van Antwerp discloses making its catheter from polyethylene, which is an organic crosslinkable polymer resin. Ex. 1005, 3:65–67. Patent Owner does not dispute this teaching. Accordingly, we find that Van Antwerp teaches making the substrate or coating from organic crosslinkable polymer resin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 6 would have been obvious over Van Antwerp.

h. Claim 7

Claim 7 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin comprise[] a functional group of acetoacetate, acid, amine, carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof.” Ex. 1001, 16:19–22. Petitioner argues that Moon teaches or suggests this limitation. Pet. 40–41 (citing Ex. 1006 ¶¶ 59, 112, 115, 119). Moon discloses antimicrobial polymeric resin materials for use in medical supplies, such as catheters, and Moon discloses that these materials may include isocyanate, hydroxyl, or epoxy functional groups. Ex. 1006 ¶¶ 59, 112, 115, 119. Patent Owner does not dispute this teaching. Accordingly, we find that Moon teaches using an organic crosslinkable polymer resin comprising “a functional group of acetoacetate, acid, amine,

¹¹ Although Petitioner includes claim 6 in the group of claims challenged as obvious over the combination of Van Antwerp and Moon, Petitioner does not rely on Moon to teach or suggest any limitation of claim 6. Pet. 32, 40.

carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof.”

In addition, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine the teachings of Moon with those of Van Antwerp because Moon discloses making a catheter, such as that disclosed in Van Antwerp, from materials that have improved antimicrobial characteristics. Pet. 41. The use of Moon’s materials to make Van Antwerp’s catheter is no more than the combination of prior-art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 417. Moreover, Patent Owner does not dispute that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Antwerp and Moon. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 7 would have been obvious over the combination of Van Antwerp and Moon.

i. Claim 8

Claim 8 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin [be] aminoplasts, melamine formaldehydes, carbamates, polyurethanes, polyacrylates, epoxies, polycarbonates, alkyds, vinyls, polyamides, polyolefins, phenolic resins, polyesters, polysiloxanes, or combinations thereof.” Ex. 1001, 16:23–27. Petitioner argues that Van Antwerp teaches or suggests this limitation.¹² Pet. 41–42 (citing Ex. 1005, 3:65–67). Van Antwerp discloses making its

¹² Although Petitioner includes claim 8 in the group of claims challenged as obvious over the combination of Van Antwerp and Moon, Petitioner does not rely on Moon to teach or suggest any limitation of claim 8. Pet. 32, 41–42.

catheter from polyethylene, which is a polyolefin. Ex. 1005, 3:65–67. Patent Owner does not dispute this teaching. Accordingly, we find that Van Antwerp teaches making the substrate or coating from an organic crosslinkable polymer resin that is a polyolefin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 8 would have been obvious over Van Antwerp.

j. Claim 9

Claim 9 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer [be] a hydroxyl-functionalized acrylate resin.” Ex. 1001, 16:28–29. Petitioner argues that Moon teaches or suggests this limitation. Pet. 42–43 (citing Ex. 1006 ¶¶ 59, 112, 115, 120–122). Moon discloses some polymers that are hydroxyl-functionalized acrylate resins. Ex. 1006 ¶¶ 120–122. Patent Owner does not dispute this teaching. Accordingly, we find that Moon teaches using a hydroxyl-functionalized acrylate resin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 9 would have been obvious over the combination of Van Antwerp and Moon.

k. Claim 10

Claim 10 depends from claim 1 and adds a limitation requiring that the lipase be “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase, phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase.” Ex. 1001, 16:30–34. Petitioner argues that Hamade teaches or suggests this limitation. Pet. 43–44 (citing Ex. 1007, 4:7–15, 7:31–35). Hamade discloses a coating that produces antimicrobial activity using an enzyme that can be lipase, such as triacylglycerol lipase or

lipoprotein lipase. Ex. 1007, 4:7–15, 7:31–35. Patent Owner does not dispute this teaching. Accordingly, we find that Hamade teaches using a lipase that is “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase, phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase.”

In addition, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine the teachings of Hamade with those of Van Antwerp because a person of ordinary skill in the art would have sought enzymes that “exhibit enzymatic activity against various lipids.” Pet. 44. The use of Hamade’s lipases to coat Van Antwerp’s catheter is no more than the combination of prior-art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 417. Moreover, Patent Owner does not dispute that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Antwerp and Hamade. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 10 would have been obvious over the combination of Van Antwerp and Hamade.

l. Claim 11

Claim 11 depends from claim 1 and adds a limitation requiring that the lipase be “a triacylglycerol lipase.” Ex. 1001, 16:35–36. Petitioner argues that Hamade teaches or suggests this limitation. Pet. 44–45 (citing Ex. 1007, 4:7–15, 7:31–35). Hamade discloses a coating that produces antimicrobial activity using an enzyme that can be lipase, such as triacylglycerol lipase or lipoprotein lipase. Ex. 1007, 4:7–15, 7:31–35. Patent Owner does not dispute this teaching. Accordingly, we find that

Hamade teaches using triacylglycerol lipase, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 11 would have been obvious over the combination of Van Antwerp and Hamade.

C. Asserted Obviousness on Grounds Relating to Schneider

We instituted trial to determine whether the subject matter of claims 1–8, 10, and 11 would have been obvious to a person of ordinary skill in the art given the teachings of Schneider. Inst. Dec. 6–9, 30; *see* Pet. 36–39. In addition, we instituted trial to determine whether the subject matter of claim 9 would have been obvious to a person of ordinary skill in the art given the teachings of Schneider and McDaniel.

1. Schneider

Schneider “relates to a coating composition comprising at least one enzyme capable of acting on a compound, wherein said action results in the formation of an antifouling species comprising an antifouling activity.” Ex. 1004, at [57]. The enzymes used in Schneider include “an esterase, including a lipase.” *Id.* ¶ 52. When a lipase is used, Schneider teaches that it “degrade[s] cell wall lipids and other lipid associated macro-molecules at the surface of microbial organisms.” *Id.* ¶ 72.

2. McDaniel

McDaniel relates to “novel coatings and paints comprising a biomolecule composition.” Ex. 1008, at [57]. McDaniel discloses a “composition . . . that comprises a bioactive molecule such as an enzyme composition that retains activity after being admixed with paint.” *Id.* ¶ 23. In addition to “paint,” McDaniel teaches mixing its enzyme with “a thermosetting acrylic resin,” which can be crosslinked with binders comprising hydroxyl functional groups. *Id.* ¶¶ 503–504.

3. *Analysis*

a. Claim 1

In each of the Schneider grounds, Petitioner relies on Schneider to teach or suggest the limitations of claim 1, except for “facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint,” which we discuss above with respect to the Van Antwerp grounds. Pet. 46–48. Patent Owner does not oppose the argument that Schneider teaches or suggests “providing a substrate or a coating” and “associating a lipase with said substrate or coating such that said lipase is capable of enzymatically degrading a component of a fingerprint.” PO Resp. 8–9, 11–49. We agree with both parties that Schneider teaches or suggests these two limitations. Ex. 1004 ¶¶ 50, 52, 74, 88–90, 96, 125, 247, 248, 253, 262, 269 (teaching a “coating composition comprising at least one enzyme” that may be “a lipase” that is “capable of reducing and/or eliminating fouling in the form of microbial growth”); Ex. 1010 ¶ 35 (lipids “are well-known to be among the components of fingerprints”); Ex. 1013, 90–91 (chemical analysis of materials extracted from fingertips using rubbing alcohol contained lipid compounds). Accordingly, Petitioner has shown that Schneider teaches the first two method steps of claim 1. As discussed above with respect to the Van Antwerp grounds, the third step would occur inherently once the first two steps were performed. *See supra* Analysis § B.5.a.(2). Accordingly, Petitioner has proven by a preponderance of the evidence that claim 1 would have been obvious over Schneider.

b. Claim 2

Claim 2 of the '618 patent depends from claim 1 and adds a limitation requiring that the lipase be “covalently attached to [the] substrate or [the] coating.” Ex. 1001, 15:28–29. Petitioner argues that this type of enzyme-substrate bonding was well-known in the art. Pet. 48–49 (citing Ex. 1010 ¶ 42). Dr. Rozzell’s testimony, to which Petitioner cites, is supported by evidence that covalent bonding of enzymes was known in the art. Ex. 1010, Attachment G. It also is not contradicted by any evidence or argument to the contrary. Accordingly, we find that covalent bonding between an enzyme and a substrate was well-known in the art, and we conclude that claim 2 would have been obvious over Schneider.

c. Claim 3

Claim 3 depends from claim 1 and requires that the lipase be “non-covalently adhered to or admixed into [the] substrate or [the] coating.” Ex. 1001, 15:30–32. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 49 (citing Ex. 1004 ¶¶ 110, 263). Schneider discloses that its compositions “can be prepared simply by mixing the various ingredients at a temperature at which they are not adversely affected.” Ex. 1004 ¶ 263. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches attaching the lipase to the surface using non-covalent bonding, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 3 would have been obvious over Schneider.

d. Claim 4

Claim 4 depends from claim 1 and adds a limitation requiring “heating [the] substrate or [the] coating or applying heat to a surface of said

substrate or said coating subsequent to being contacted by a fingerprint.” Ex. 1001, 15:33–35. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 49–50 (citing Ex. 1004 ¶¶ 249, 269). Schneider discloses using its coating on the “external surface of a central heating system.” Ex. 1004 ¶ 249. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches heating a substrate or coating, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 4 would have been obvious over Schneider.

e. Claim 5

Claim 5 depends from claim 4 and adds a limitation requiring that the heating take place “for at least 30 minutes.” Ex. 1001, 15:36–37. Citing to Dr. Rozzell’s testimony, Petitioner argues that Schneider teaches or suggests this limitation. Pet. 49–50 (citing Ex. 1004 ¶¶ 249, 269; Ex. 1010 ¶ 149). Dr. Rozzell’s testimony is evidence that a person of ordinary skill in the art would have known that the coating formulation of the “external surface of a central heating system” that Schneider describes could be “exposed to heated air for several hours each day.” Ex. 1004 ¶ 249; Ex. 1010 ¶ 149. That testimony is not contradicted by any evidence or argument to the contrary. Accordingly, we find that Schneider teaches heating the substrate or coating for at least 30 minutes, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 5 would have been obvious over Schneider.

f. Claim 6

Claim 6 depends from claim 1 and adds a limitation requiring that the substrate or coating “comprise[] an organic crosslinkable polymer resin.” Ex. 1001, 16:17–18. Petitioner argues that Schneider teaches or suggests

this limitation. Pet. 50 (citing Ex. 1004 ¶¶ 225, 253). Schneider discloses making its coatings from alkyd, epoxy, urethane, polyester, vinyl, or phenolic resins, all of which are organic crosslinkable polymer resins. Ex. 1004 ¶ 253. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches making the substrate or coating from organic crosslinkable polymer resin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 6 would have been obvious over Schneider.

g. Claim 7

Claim 7 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin comprise[] a functional group of acetoacetate, acid, amine, carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof.” Ex. 1001, 16:19–22. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 50–51 (citing Ex. 1004 ¶ 253; Ex. 1010 ¶ 153). Schneider discloses making its coatings from alkyd, epoxy, urethane, or phenolic resins. Ex. 1004 ¶ 253. Dr. Rozzell testifies that epoxy, urethane, and phenolic resins “comprise epoxy, isocyanate, and hydroxyl functional groups, respectively.” Ex. 1010 ¶ 153. Patent Owner does not dispute this evidence. Accordingly, we find that Schneider teaches using an organic crosslinkable polymer resin comprising “a functional group of acetoacetate, acid, amine, carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof,” and we conclude that Petitioner has shown by a preponderance of the evidence that claim 7 would have been obvious over Schneider.

h. Claim 8

Claim 8 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin [be] aminoplasts, melamine formaldehydes, carbamates, polyurethanes, polyacrylates, epoxies, polycarbonates, alkyds, vinyls, polyamides, polyolefins, phenolic resins, polyesters, polysiloxanes, or combinations thereof.” Ex. 1001, 16:23–27. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 51 (citing Ex. 1004 ¶ 253). Schneider discloses making its coatings from alkyd, epoxy, urethane, polyester, vinyl, or phenolic resins, all of which are organic crosslinkable polymer resins. Ex. 1004 ¶ 253. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches using an organic crosslinkable polymer resin that is “aminoplasts, melamine formaldehydes, carbamates, polyurethanes, polyacrylates, epoxies, polycarbonates, alkyds, vinyls, polyamides, polyolefins, phenolic resins, polyesters, polysiloxanes, or combinations thereof,” and we conclude that Petitioner has shown by a preponderance of the evidence that claim 8 would have been obvious over Schneider.

i. Claim 9

Claim 9 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer [be] a hydroxyl-functionalized acrylate resin.” Ex. 1001, 16:28–29. Petitioner argues that McDaniel teaches or suggests this limitation. Pet. 52 (citing Ex. 1008 ¶¶ 379, 454, 503, 504, 510, 512). McDaniel discloses some polymers that are hydroxyl-functionalized acrylate resins. Ex. 1008 ¶¶ 503–504. Patent Owner does not dispute this teaching. Accordingly, we find that McDaniel teaches using a hydroxyl-functionalized acrylate resin.

In addition, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine the teachings of McDaniel with those of Schneider because a person of ordinary skill in the art would have sought “material compositions that are well-known to provide desirable performance for enzyme-containing polymeric coatings and a hydroxyl-functionalized acrylate resin is well-known to provide desirable performance for enzyme-containing polymeric coatings.” Pet. 52 (citing Ex. 1010 ¶¶ 162–163). The use of McDaniel’s hydroxyl-functionalized acrylate resin in Schneider’s coating composition is no more than the combination of prior-art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 417. Moreover, Patent Owner does not dispute that a person of ordinary skill in the art would have had a reason to combine the teachings of Schneider and McDaniel. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 9 would have been obvious over the combination of Schneider and McDaniel.

j. Claim 10

Claim 10 depends from claim 1 and adds a limitation requiring that the lipase be “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase, phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase.” Ex. 1001, 16:30–34. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 52–53 (citing Ex. 1004 ¶ 74). Schneider discloses that its enzyme can be a lipase, such as triacylglycerol lipase or lipoprotein lipase. Ex. 1004 ¶ 74. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches using a lipase that is “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase,

phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase,” and we conclude that Petitioner has shown by a preponderance of the evidence that claim 10 would have been obvious over Schneider.

k. Claim 11

Claim 11 depends from claim 1 and adds a limitation requiring that the lipase be “a triacylglycerol lipase.” Ex. 1001, 16:35–36. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 53 (citing Ex. 1004 ¶ 74). Schneider discloses that its enzyme can be a lipase, such as triacylglycerol lipase or lipoprotein lipase. Ex. 1004 ¶ 74. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches using a triacylglycerol lipase, and we conclude that Petitioner has shown by a preponderance of the evidence that claim 11 would have been obvious over Schneider.

D. Asserted Obviousness on Grounds Relating to Drevon

We instituted trial to determine whether the subject matter of claims 1–9 would have been obvious to a person of ordinary skill in the art given the teachings of Drevon. Inst. Dec. 6–9, 30; *see* Pet. 36–39. In addition, we instituted trial to determine whether the subject matter of claims 10 and 11 would have been obvious to a person of ordinary skill in the art given the teachings of Drevon and Schneider.

1. *Drevon*

Drevon relates to “strategies to immobilize enzymes into various polymer[s] and coatings.” Ex. 1003, 3.¹³ It discloses that “enzymes were inserted into various polymer networks,” including “[p]olyurethane foams.” *Id.* at 19. The enzymes used included lipase. *Id.* at 79.

2. *Analysis*

a. Claim 1

In each of the Drevon grounds, Petitioner relies on Drevon to teach or suggest the limitations of claim 1, except for “facilitating the removal of a fingerprint by vaporization from the lipase associated substrate or coating when contacted by a fingerprint,” which we discuss above with respect to the Van Antwerp grounds. Pet. 53–56. Patent Owner does not oppose the argument that Drevon teaches or suggests “providing a substrate or a coating” and “associating a lipase with said substrate or coating such that said lipase is capable of enzymatically degrading a component of a fingerprint.” PO Resp. 8–9, 11–49. We agree with both parties that Drevon teaches or suggests these two limitations. Ex. 1003, 18–20, 70, 77, 79, 88, 169, 214 (teaching “[c]ovalent immobilization” of enzymes, including lipase, on a polymer support surface while “optimiz[ing] the catalytic efficiency . . . of the resulting biopolymers”); Ex. 1010 ¶ 35 (lipids “are well-known to be among the components of fingerprints”); Ex. 1013, 90–91 (chemical analysis of materials extracted from fingertips using rubbing alcohol contained lipid compounds). Accordingly, Petitioner has shown that

¹³ Citations to Drevon refer to the page numbers that Petitioner inserted into the lower right corners of Ex. 1003, not to the original page numbers in the lower center of each page.

Drevon teaches the first two method steps of claim 1. As discussed above with respect to the Van Antwerp grounds, the third step would occur inherently once the first two steps were performed. *See supra* Analysis § B.5.a.(2). Accordingly, Petitioner has proven by a preponderance of the evidence that claim 1 would have been obvious over Drevon.

b. Claim 2

Claim 2 of the '618 patent depends from claim 1 and adds a limitation requiring that the lipase be “covalently attached to [the] substrate or [the] coating.” Ex. 1001, 15:28–29. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 56 (citing Ex. 1003, 18, 57–58). Drevon discloses “the covalent attachment of the enzyme onto or into a solid support.” Ex. 1003, 57. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches or suggests attaching the lipase to the surface using covalent bonding, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 2 would have been obvious over Drevon.

c. Claim 3

Claim 3 depends from claim 1 and requires that the lipase be “non-covalently adhered to or admixed into [the] substrate or [the] coating.” Ex. 1001, 15:30–32. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 56 (citing Ex. 1003, 18, 56–57, 76–77). Drevon discloses that its enzymes can be immobilized by “[s]everal non-covalent linkages . . . including ionic and metal bindings as well as physical adsorption.” Ex. 1003, 56. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches attaching the lipase to the surface using non-covalent bonding, and we conclude that Petitioner has proven by a

preponderance of the evidence that claim 3 would have been obvious over Drevon.

d. Claim 4

Claim 4 depends from claim 1 and adds a limitation requiring “heating [the] substrate or [the] coating or applying heat to a surface of said substrate or said coating subsequent to being contacted by a fingerprint.” Ex. 1001, 15:33–35. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 56 (citing Ex. 1003, 18, 58). Drevon discloses that one purpose of enzyme immobilization is “to prevent enzyme unfolding upon heating.” Ex. 1003, 18. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches heating a substrate or coating, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 4 would have been obvious over Drevon.

e. Claim 5

Claim 5 depends from claim 4 and adds a limitation requiring that the heating take place “for at least 30 minutes.” Ex. 1001, 15:36–37. Petitioner argues that a person of ordinary skill in the art would have known that “substrate surfaces and coating surfaces of . . . consumer products that are exposed to bioorganic stains are routinely subjected to heating for at least 30 minutes during their routine use.” Pet. 57 (citing Ex. 1010 ¶¶ 178–179). Dr. Rozzell testifies to this, Ex. 1010 ¶¶ 178–179, and Dr. Rozzell’s testimony is not contradicted by any evidence or argument to the contrary. Accordingly, we find that Drevon teaches heating the substrate or coating for at least 30 minutes, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 5 would have been obvious over Drevon.

f. Claim 6

Claim 6 depends from claim 1 and adds a limitation requiring that the substrate or coating “comprise[] an organic crosslinkable polymer resin.” Ex. 1001, 16:17–18. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 57–58 (citing Ex. 1003, 68, 70, 77, 101, 106, 169). Drevon discloses making its coatings from polyurethane and acrylic resins, as well as acrylate polymer or polyacrylate, all of which are organic crosslinkable polymer resins, and Drevon discloses crosslinking polyurethane. Ex. 1003, 68, 70, 77, 101, 106, 169. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches making the substrate or coating from organic crosslinkable polymer resin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 6 would have been obvious over Drevon.

g. Claim 7

Claim 7 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin comprise[] a functional group of acetoacetate, acid, amine, carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof.” Ex. 1001, 16:19–22. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 58 (citing Ex. 1003, 58, 68, 70, 101, 106). Drevon discloses that its polymer resins can include amine, hydroxyl, and isocyanate functional groups. Ex. 1003, 58, 68, 70, 101, 106. Patent Owner does not dispute this evidence. Accordingly, we find that Drevon teaches using an organic crosslinkable polymer resin comprising “a functional group of acetoacetate, acid, amine, carboxyl, epoxy, hydroxyl, isocyanate, silane, vinyl, or combinations thereof,” and we conclude that

Petitioner has shown by a preponderance of the evidence that claim 7 would have been obvious over Drevon.

h. Claim 8

Claim 8 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer resin [be] aminoplasts, melamine formaldehydes, carbamates, polyurethanes, polyacrylates, epoxies, polycarbonates, alkyds, vinyls, polyamides, polyolefins, phenolic resins, polyesters, polysiloxanes, or combinations thereof.” Ex. 1001, 16:23–27. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 58–59 (citing Ex. 1003, 68, 70, 101, 169). Drevon discloses using polyacrylate and polyurethane. Ex. 1003, 68, 70, 101, 169. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches using an organic crosslinkable polymer resin that is “aminoplasts, melamine formaldehydes, carbamates, polyurethanes, polyacrylates, epoxies, polycarbonates, alkyds, vinyls, polyamides, polyolefins, phenolic resins, polyesters, polysiloxanes, or combinations thereof,” and we conclude that Petitioner has shown by a preponderance of the evidence that claim 8 would have been obvious over Drevon.

i. Claim 9

Claim 9 depends from claim 6 and adds a limitation requiring that the “organic crosslinkable polymer [be] a hydroxyl-functionalized acrylate resin.” Ex. 1001, 16:28–29. Petitioner argues that Drevon teaches or suggests this limitation. Pet. 59 (citing Ex. 1003, 101, 106, 169). Drevon discloses some polymers that are hydroxyl-functionalized acrylate resins. Ex. 1003, 101, 106, 169. Patent Owner does not dispute this teaching. Accordingly, we find that Drevon teaches using a hydroxyl-functionalized

acrylate resin, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 9 would have been obvious over Drevon.

j. Claim 10

Claim 10 depends from claim 1 and adds a limitation requiring that the lipase be “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase, phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase.” Ex. 1001, 16:30–34. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 59–61 (citing Ex. 1004 ¶ 74). Schneider discloses that its enzyme can be a lipase, such as triacylglycerol lipase or lipoprotein lipase. Ex. 1004 ¶ 74. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches using a lipase that is “lipoprotein lipase, acylglycerol lipase, hormone-sensitive lipase, phospholipase A1, phospholipase A2, phospholipase C, phospholipase D, phosphoinositide phospholipase C, a lysophospholipase, or a galactolipase.”

In addition, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine the teachings of Schneider with those of Drevon because a person of ordinary skill in the art would have sought “enzymes that exhibit enzymatic activity against various lipids,” in light of Drevon’s suggestion that immobilized enzymes could be used for antifouling purposes. Pet. 60–61. The use of Schneider’s lipases in Drevon’s polymer matrices is no more than the combination of prior-art elements according to known methods to yield predictable results. *KSR*, 550 U.S. at 417. Moreover, Patent Owner does not dispute that a person of ordinary skill in the art would have had a reason to combine the teachings of

Drevon and Schneider. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 10 would have been obvious over the combination of Drevon and Schneider.

k. Claim 11

Claim 11 depends from claim 1 and adds a limitation requiring that the lipase be “a triacylglycerol lipase.” Ex. 1001, 16:35–36. Petitioner argues that Schneider teaches or suggests this limitation. Pet. 61–63 (citing Ex. 1004 ¶ 74). Schneider discloses that its enzyme can be a lipase, such as triacylglycerol lipase or lipoprotein lipase. Ex. 1004 ¶ 74. Patent Owner does not dispute this teaching. Accordingly, we find that Schneider teaches using triacylglycerol lipase, and we conclude that Petitioner has proven by a preponderance of the evidence that claim 11 would have been obvious over the combination of Drevon and Schneider.

CONCLUSION

Upon consideration of the full record after trial, we determine that Petitioner has proven by a preponderance of the evidence that the following claims are unpatentable under 35 U.S.C. § 103: (1) claims 1–3 as obvious over Van Antwerp; (2) claims 4 and 5 as obvious over Van Antwerp and Bostek; (3) claims 6–9 as obvious over Van Antwerp and Moon; (4) claims 10 and 11 as obvious over Van Antwerp and Hamade; (5) claims 1–8, 10, and 11 as obvious over Schneider; (6) claim 9 as obvious over Schneider and McDaniel; (7) claims 1–9 as obvious over Drevon; and (8) claims 10 and 11 as obvious over Drevon and Schneider.

ORDER

It is hereby

ORDERED that Petitioner has proven that claims 1–11 of U.S. Patent No. 8,394,618 B2 are unpatentable;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 318(b), upon expiration of the time for appeal of this decision, or the termination of any such appeal, a certificate shall issue canceling claims 1–11 of U.S. Patent No. 8,394,618 B2; and

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

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PETITIONER:

David O. Simmons
IVC PATENT AGENCY
dsimmons@ivcpatentagency.com

Jonathan D. Hurt
MCDANIEL & ASSOCIATES, PC
jhurt@technologylitigators.com

Mark A.J. Fassold
Jorge Mares
WATTS GUERRA LLP
mfassold@wattsguerra.com
jmares@wattsguerra.com

PATENT OWNER:

Joshua A. Lorentz
Richard Schabowsky
John D. Luken
Oleg Khariton
DINSMORE & SHOHL LLP
joshua.lorentz@dinsmore.com
richard.schabowsky@dinsmore.com
john.luken@dinsmore.com
oleg.khariton@dinsmore.com