

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DANISCO US INC.,
Petitioner,

v.

NOVOZYMES NORTH AMERICA, INC.,
Patent Owner.

IPR2020-00464
Patent 7,820,419 B2

Before GRACE KARAFFA OBERMANN, ROBERT A. POLLOCK, and
RYAN H. FLAX, *Administrative Patent Judges*.

FLAX, *Administrative Patent Judge*.

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

I. INTRODUCTION

Danisco US Inc. (“Petitioner”) filed a Petition for an *inter partes* review of claims 1–9, 11, and 13–19 of U.S. Patent 7,820,419 B2 (“the ’419 patent,” Ex. 1001). Paper 1 (“Pet.”). Novozymes North America, Inc. (“Patent Owner”) filed a Response.¹ Paper 19 (“Resp.”). Petitioner filed a Reply to Patent Owner’s Response (“Reply,” Paper 25) and Patent Owner filed a Sur-Reply (“Sur-Reply,” Paper 33). A final hearing was held on April 27, 2021, at which the parties presented oral argument. *See* Paper 40 (“Hr’g Tr.”).

We have authority under 35 U.S.C. § 6. 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 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. After considering the parties’ arguments and supporting evidence, we conclude that Petitioner has proven by a preponderance of the evidence that claims 1–9, 11, and 13–19 of the ’419 patent are unpatentable. 35 U.S.C. § 316(e).

A. *REAL PARTIES-IN-INTEREST*

Petitioner identifies itself, “Danisco US Inc.,” and “International Flavors & Fragrances Inc.” as the real parties-in-interest. Paper 24. Patent

¹ Patent Owner also filed a pre-institution Preliminary Response (Paper 7, “Prelim. Resp.”), which is referenced herein. Our Institution Decision is also referenced herein. Paper 12 (“DI”).

Owner identifies itself, “Novozymes North America, Inc.,” as the real party-in-interest. Paper 5.

B. RELATED MATTERS

The parties identify “*Novozymes North America, Inc. v. Danisco US Inc. & DuPont Nutrition & Biosciences*, No. 19-1902 (D. Del. filed Oct. 8, 2019)” as a related matter. Pet. 4; Paper 5.

C. THE ’419 PATENT

The ’419 patent issued on October 26, 2010, from Application 11/814,304, which was filed on February 7, 2006, and claims priority to U.S. Provisional Application 60/651,001, filed on February 8, 2005. Ex. 1001, codes (45), (21), (22), (60). The ’419 patent’s Abstract states:

The present invention relates to a process for producing a fermentation product from starch-containing material, comprising liquefying said starch-containing material with an alpha-amylase; treating with a protease; saccharifying in the presence of a carbohydrate-source generating enzyme; fermenting in the presence of a fermenting organism.

Id. at Abstract.^{2,3} The Specification further explains that

[t]ypically ethanol is produced by liquefying starch-containing material followed by sequential or simultaneous saccharification and fermentation. Liquefaction involves gelatinization of starch simultaneously with or followed by addition of alpha-amylase in order to degrade starch into

² Alpha-amylase, which may also be written as α -amylase, refers to an enzyme that hydrolyzes the alpha bonds of starch; it may be fungal or bacterial in origin. *See* Ex. 1001, 8:54–11:24; *see also* Ex. 2001 ¶¶ 21–22, 29 (discussing α -amylase); *see also* Ex. 2037, 400 (The Alcohol Textbook, 4th ed., defining “ α -amylase”).

³ Protease refers to a protein-degrading enzyme and may be, for example, peptidase, endo-protease, or exo-protease, and may be of fungal, bacterial, yeast, or plant origin. *See* Ex. 1001, 7:29–8:53; *see also* Ex. 1002 ¶¶ 23–26 (discussing proteases).

dextrins. When producing ethanol the liquefied starch-containing material is saccharified. Saccharification is a step in which dextrins are converted to low molecular DP₁₋₃ sugars that, e.g., can be converted by a yeast into ethanol [via fermentation].

Id. at 1:44–52. The Specification further explains that, in the prior art, it was known to introduce a protease to the liquefied mash produced by the liquefaction step during the saccharification and/or fermentation steps. *Id.* at 1:53–2:4. Fermenting is a process step where a fermenting organism, e.g., yeast, produces alcohol, e.g., ethanol, from the saccharified liquefied mash. *Id.* at 1:23–35, 2:18, 6:1–8. The Specification explains that adding protease during the ethanol production process in such a way results in increased amino nitrogen and, thereby, accelerates the rate of ethanol fermentation, increases ethanol production and productivity, and lowers glycerol production (which is an undesirable by-product and indicates lower ethanol yield). *Id.* at 2:1–4, 3:7–21.

The '419 patent describes that “[l]iquefaction is a process step in which starch-containing material, preferably milled (whole) grain, is broken down (hydrolyzed) into maltodextrins (dextrins). Liquefaction is typically carried out using an α -amylase or by other means known in the art to provide such effect (e.g., acid hydrolysis).” *Id.* at 4:3–8. The Specification explains that “[t]he starting material” for liquefaction is preferably “milled whole grains, especially corn, wheat and milo.” *Id.* at 4:16–18. The Specification explains that milled grains and water form a slurry, which can be heated for the gelatinization of the starch material, which begins between 55° and 75°C. *Id.* at 4:28–34. Added α -amylase is explained by the '419 patent to initiate and finalize liquefaction (thinning) of the slurry by hydrolysis. *Id.* at

4:49–58. The '419 patent states that “[m]illed and liquefied whole grains are known as mash.” *Id.* at 4:59.

The Specification describes protease treatment initiated either after completing a liquefaction step or during a liquefaction step. *Id.* at 4:1–5:41. When protease treatment is performed post-liquefaction, the '419 patent explains “that the temperature during protease treatment in step (b) would be in the range from between 25–90°C” and “a person of ordinary skill in the art can easily determine optimal conditions for carrying out the post liquefaction step,” where “[t]he protease may be of any origin.” *Id.* at 4:62–5:14. When protease treatment and liquefaction are performed simultaneously, the '419 patent again states that “[t]he temperature during protease treatment depends on the enzymes used, but may be in the range from 25–90°C” and “[i]f the protease and alpha-amylase used are heat stable, temperature in the higher ranges may be used.” *Id.* at 5:23–28. Regarding this simultaneous treatment, the '419 patent further states, “[i]t should be understood that degradation of protein contained in the starch-containing material may be initiated (by addition of protease) at any time during liquefaction, for instance, by addition to the aqueous slurry prior to step (a),” where step (a) is defined as “liquefying said starch-containing material with an alpha-amylase.” *Id.* at 4:59–60, 5:37–41.

The '419 patent describes proteases that are suitable for use in its process as being “of any origin,” but provides several examples. *Id.* at 7:29–8:53. The Specification states, “[a]ddition of protease(s) increase(s) the FAN (Free amino nitrogen) level and increases the rate of metabolism of the fermenting organism, such as yeast, and further gives higher fermentation

efficiency. According to the invention a peptidase and other protein degrading enzymes are referred to as proteases.” *Id.* at 7:32–37.

The ’419 patent provides two examples, one of a “Post Liquefaction Protease Treatment of Corn Mash” where a protease was added to liquefied corn mash, and one of a “Simultaneous Liquefaction and Protein Degradation” where two proteases (Protease ALC and Peptidase A) and an α -amylase were added to a corn slurry during liquefaction. *Id.* at 16:35–18:41; *see also id.* at 13:30–45 (identifying enzymes). Each exemplary process resulted in increased ethanol yield, lowered glycerol levels, and an improved glycerol/ethanol ratio as compared to control processes that did not add protease. *Id.* at 17:15–24, 18:1–41, Figs. 1–6.

Regarding the steps of saccharification and fermentation that follow liquefaction, the ’419 patent states that each is well-known in the art. *Id.* at 5:47–48, 6:30–33.

Claim 1, the ’419 patent’s sole independent claim, reads as follows:

1. A process for producing an alcohol from starch-containing material, comprising
 - (a) liquefying said starch-containing material with an alpha-amylase;
 - (b) treating the liquefied mash from step (a) with a protease before initiating step (c);
 - (c) saccharifying in the presence of a carbohydrate-source generating enzyme;
 - (d) fermenting in the presence of a fermenting organism to produce the alcohol.

Id. at 18:43–53. In addition to claim 1, the ’419 patent includes dependent claims 2–19, which more specifically define aspects of the claimed method. For example, claim 2 further requires “[t]he process of claim 1, wherein

steps (a) and (b) are carried out simultaneously or sequentially,” and claim 8 further requires “[t]he process of claim 7, wherein the slurry is heated to above the initial gelatinization temperature.” *Id.* at 18:54–55, 19:1–2.

Claim 8 depends from claim 1 via dependence from intervening claim 7, which further requires “prior to the step (a) [of claim 1], the steps of: i) milling of starch-containing material; ii) forming a slurry comprising the milled starch-containing material and water.” *Id.* at 18:63–67. Moreover, claims 14 and 17, respectively, further define the conditions and parameters for “the protease treatment in step (b)” of claim 1 to be “a temperature of 25–90° C” and a duration of “0.1 to 12 hours.” *Id.* at 19:13–14, 20:4–5.

D. PETITIONER’S ASSERTED GROUNDS FOR UNPATENTABILITY

Petitioner asserts the following grounds for the unpatentability of claims 1–9, 11, 13–19 of the ’419 patent:

GROUND	CLAIMS CHALLENGED	35 U.S.C. § ⁴	REFERENCE(S)/BASIS
1	1–7, 11, 14, 15, 17, 18	102	WO ’179 ⁵
2	1–9, 11, 13–19	103	WO ’179, Goode, ⁶ WO ’895 ⁷

⁴ The ’419 patent was filed on February 7, 2006, before the AIA revisions to 35 U.S.C. §§ 102 and 103 took effect. Therefore, the pre-AIA version of Sections 102 and 103 apply. However, the outcome of this Decision would not change regardless of which version of the statutes applies.

⁵ WO 97/29179 (published Aug. 14, 1997) (Ex. 1003 (“WO ’179”)).

⁶ Declan L. Goode et al., *Optimization of Mashing Conditions when Mashing with Unmalted Sorghum and Commercial Enzymes*, 61(2) J. AM. SOC. BREW. CHEM. 69–78 (2003) (Ex. 1004 (“Goode”)).

⁷ WO 01/074895 A2 (published Sept. 26, 2002) (Ex. 1005 (“WO ’895”)).

In support of these grounds for unpatentability Petitioner submits, *inter alia*, the Declaration and Reply Declaration of Douglas S. Clark, Ph.D. Ex. 1002; Ex. 1020. In support of its positions, Patent Owner submits, *inter alia*, the Declaration and Second Declaration of Scott D. Kohl, Ph.D. Ex. 2001; Ex. 2011. We find that Dr. Clark and Dr. Kohl are each qualified to offer testimony on the knowledge of one of ordinary skill in the art at the time of the invention. *See* Ex. 1002 ¶¶ 1–15 (Dr. Clark’s statements as to his background and qualifications); Ex. 2001 ¶¶ 1–19 (Dr. Kohl’s statements as to his background and qualifications).

E. WO ’179

WO ’179 is the August 14, 1997 published version of International Application PCT/EP97/00686, which was filed on February 12, 1997, and claims priority to a pair of European Patent Office Applications, the earliest of which was filed on February 12, 1996. Ex. 1003, codes (43), (21), (22), (30). Irrespective of its priority claims, WO ’179 is prior art to the claims of the ’419 patent under 35 U.S.C. § 102(b); this is not disputed by Patent Owner. *See generally* Resp.; Sur-Reply.

WO ’179 discloses:

a process for the production of a fermentable wort from cereal grains, comprising the steps of:

- (a) liquefaction of cereal material, with the aid of α -amylase and/or endoprotease activity, to obtain a liquefied mash;
- (b) saccharification of the said liquefied mash in the presence of α -amylase;
- (c) filtration of the liquefied and saccharified mash to obtain a fermentable wort,

wherein at least one of the steps (a) and (b) above is carried out in the presence of an enzyme having exo-peptidase activity.

Ex. 1003, Abstract (paragraphing added); *see also id.* at 2:19–30.⁸ The aforementioned “fermentable wort” is further explained as being an intermediate product for “the production of alcohol, in the distilling industry or in the brewing of beer.” *Id.* at 1:8–12. WO ’179 also further explains that the aforementioned “cereal grains” from which alcohol is produced can be sorghum, **corn**, **barley**, rice, **wheat**, **oat**, or combinations thereof.⁹ *Id.* at 2:11–18, 4:6–10.

WO ’179 discloses, “a process . . . for ***enzymatically releasing freely available nitrogen*** from cereals containing high amounts of glutelin and/or prolamin, comprising the step of ***adding to*** the grains, or ***a liquefied mash obtained from said grain***, a combination of an ***endoprotease*** and an ***exo-peptidase***,” whereby, ultimately, alcohol is produced by fermentation. *Id.* at 3:10–13 (emphasis added). WO ’179 explains “[t]he use of exopeptidases according to [its] invention does not only lead to an ***increase of the freely***

⁸ WO ’179 includes original page numbering at the top of each page and added page numbering at the bottom corner of each page. We cite to the original page numbering herein.

⁹ Gelatinization temperatures of the bolded grains are relevant to our analysis in Section II, *infra*. According to Patent Owner’s witness, Dr. Kohl, barley gelatinizes over the temperature range 51.5–57–59.5°C (indicating the initial, mid-point, and completion gelatinization temperatures, respectively), wheat gelatinizes over the temperature range 58–61–64°C, and corn gelatinizes over the temperature range 62–67–72°C. *See* Ex. 2011 ¶ 98 (citing Ex. 2027, 668 (Table III); Ex. Ex. 2037, 12 (Table 3)). Patent Owner’s Exhibit 2030 (Encyclopedia of Food Sciences and Nutrition) discloses that oat gelatinizes over a temperature range 53–59°C. Ex. 2030, 5571 (Table 1).

available nitrogen (FAN) of the wort, but also to an improvement of the filterability and the yield of the wort, compared to the process wherein no exopeptidases are used.” *Id.* at 4:2–5 (emphasis added); *see also id.* at 6:13–21 (explaining that higher FAN is associated with filterability and high yield, making the use of protease enzymes attractive for beverage and biofuel alcohol production).

According to WO ’179, “[u]seful [] enzymes having exo-peptidase activity are . . . preferably thermostable exopeptidases, such as the fungal amino-peptidases, but also thermostable carboxy-peptidases are useful. Particularly preferred according to the invention are amino-peptidases endogenous to *Aspergillus* fungi, more in particular *A[spergillus] niger*, *A[spergillus] oryzae* or *A[spergillus] sojae*.” *Id.* at Abstract; *see also id.* at 5:9–11 (identifying “Brewers protease” and “Panstimase 400” as useful), 6:9–12 (identifying the same exo-peptidases as the Abstract), 7:10–23 (identifying proteases from *Bacillus amyloliquefaciens* (commercially available as Brewer’s Protease 2000), and proteolytic enzymes from *Streptomyces fradiae* (commercially available as Panstimase 400), and exopeptidases from *Aspergillus niger* as useful), Fig. 3 (showing the activity temperature profile for proteases from *Aspergillus niger*).

WO ’179 states that “[a]part from the addition of exopeptidases, the preparation of the wort, for example for brewing beer, may be carried out as usual. Generally, it comprises the liquefaction of the cereal raw material to obtain a mash, followed by saccharification of the mash to obtain a wort.” *Id.* at 4:23–26. WO ’179 teaches “[a] process for producing alcohol, comprising the step of fermenting the FAN obtained according to the

process according to the invention in the presence of a yeast capable of producing alcohol.” *Id.* at 3:14–16.

WO '179 describes its liquefaction process as follows:

The ***liquefaction step usually comprises grinding of the cereal raw material to obtain a flour*** of suitable particle size, ***hydrating*** with from about 1 to about 4, preferably about 3 parts of water, and optionally, depending on the endoprotease used, from about 50 to about 300 ppm of calcium, preferably 200 ppm Ca^{2+} . Enzymes from *Bacillus stearothermophilus* appear to be less Calcium-dependent. Consequently, no Ca^{2+} supplementation is required in that case. The particle size of the ground cereals should not exceed about 3 mm; not more than 3,5% should exceed 1,3 mm; not more than 1,5% should be smaller than 0.25 mm. Enzymes that may be used in addition are cellulases, β -glucanases, and or other plant cell wall degrading enzymes.

The liquefaction medium is usually adjusted to a pH of between about 5 and 8, preferably between about 6 and 7, using, for example, calcium hydroxide. It is ***important to add α -amylase***, preferably a thermostable α -amylase to the liquefaction medium ***as well as an endoprotease in a dosage sufficient to at least partially liquefy the cereal starch***, and ***to at least partially degrade protein***. Suitable dosages of α -amylase are from about 0,5 to about 2,0, preferably about 1 - 1,5 kg per Ton, when B.A.T.S. is used. Suitable dosages of proteases are, in the case of Brewers protease 2000, more than 0.5 kg/Ton grains (kg/T), preferably more than 1 kg/T. In the case of Panstimase 400 more than 2 kg/T, preferably more than 5, more preferably more than 10 kg/T should be used.

In the liquefaction process a number of ***steps are usually carried out at elevated temperature: after adding α -amylase and protease*** the mixture is ***maintained at a temperature between about 40°C and 65°C***, preferably between about 45 and 55°C, most preferably 50°C, ***until a sufficient liquefaction is obtained***. The time needed depends on the cereal or mixture of cereals used, but ***usually from about 30 minutes till about 2 hours*** is satisfactory. Subsequently, the temperature is raised

gradually, the rate not being critical, till about 90-95°C and left at that temperature for about 30 minutes to about 1 hour.

Id. at 4:27–5:18 (emphasis added).

WO '179 discloses that, subsequent to this liquefaction process, the mixture proceeds to a saccharification step using glucoamylases, followed by a fermentation step using yeast, to produce alcohol for biofuel or as a beverage. *Id.* at 5:19–6:2.

WO '179 provides several examples (1–8) where protease enzyme is introduced during the alcohol production process at the liquefaction stage, specifically rather than at the saccharification stage of the process. *Id.* at 12–23. WO '179 explains that there are “advantages [to] introducing exo-peptidases ***at the liquefaction step rather than at the saccharification step*** in the process according to the invention.” *See, e.g., id.* at 17:24–18:14 (Example 4) (emphasis added). Other examples from WO '179 disclose a barley fermentation process where, subsequent to grinding barley to a fine flour, it is suspended in water containing B.A.T.S. α -amylase, Brewers Protease 2000, and exo-peptidase Leu-AP/T from *Aspergillus sojae* or *Aspergillus niger*, where the temperature is raised to 63°C and maintained for 30 minutes (before again raising the temperature to 90°C for 20 minutes).¹⁰ *Id.* at 22–23 (Examples 7, 8).¹¹

¹⁰ WO '179 Figure 3 discloses that these exo-peptidase proteases are active over the temperature range of just above 5°C to just below 70°C, which means they are active during the 30 minute, 63°C stage of Examples 7 and 8. Ex. 1003, 3:20–23, Fig. 3.

¹¹ As noted, according to Dr. Kohl, barley gelatinizes over the temperature range 51.5–57–59.5°C (indicating the initial, mid-point, and completion gelatinization temperatures, respectively). *See* Ex. 2011 ¶ 98 (citing Ex. 2027, 668 (Table III); Ex. 2037, 12 (Table 3)). Dr. Kohl further explains that “‘liquefied mash’ refers to the end product of the action of

The claims of WO '179 are directed to and disclose an alcohol production process as just discussed. *See id.* at 26–27. Claim 1, the sole independent claim, states:

1. A process for the production of a fermentable wort, comprising the steps of:
 - (a) liquefaction of cereal material, with the aid of α -amylase and/or endoprotease activity, to obtain a liquefied mash, and
 - (b) saccharification of the said liquefied mash in the presence of α -amylase,
 - (c) filtration of the liquefied and saccharified mash to obtain a fermentable wort,

wherein at least one of the steps (a) and (b) above is carried out in the presence of an enzyme having exo-peptidase activity.

Id. at 26:4–10. Among the claims depending from claim 1, claim 5 further requires that “the exopeptidase is present during the liquefaction of the cereal material.” *Id.* at 26:21–22. Further, claim 12 recites “[a] process for enzymatically releasing freely available nitrogen from cereals containing high amounts of glutelin and/or prolamin, ***comprising the step of adding to the grains, or a liquefied mash obtained from said grain, a combination of an endoprotease and an exo-peptidase.***” *Id.* at 27:6–9 (emphasis added).

α -amylase on gelatinized starch, i.e., starch molecules that have been substantially swollen by water with heat to allow access by the enzyme and are then hydrolyzed by the α -amylase into dextrins.” *Id.* ¶ 123 (citing Ex. 2037, 12–14). Thus, according to Patent Owner’s evidence, the milled barley suspended in water of WO '179 Examples 7 and 8 will be fully gelatinized during the disclosed step of heating to 63°C so as to be converted to liquefied mash by hydrolyzing by the present α -amylase, which liquefied mash is treated by also present and active protease. *See id.* ¶ 124 (citing Ex. 2037, 422–423); *see also* Ex. 1035, 45:4–8 (Dr. Kohl testifying that if α -amylase is present and active it will act on gelatinized starch (via dextrinization)).

F. GOODE

Goode is an article published in the Journal of the American Society of Brewing Chemists in 2003. Ex. 1004.¹² Goode is prior art to the claims of the '419 patent under 35 U.S.C. § 102(b); this is not disputed by Patent Owner. *See generally* Resp.; Sur-Reply.

Goode discloses experiments and results relating to the use of a protease during the production of liquor and its abstract states:

Small-scale mashing experiments were carried out with 100% unmalted sorghum grist. A commercial mashing program with temperature stands at 50, 95, and 60°C was carried out. A heat-stable α -amylase, a bacterial protease, and a fungal α -amylase were used in all experiments. The effects of the addition of various commercial enzymes, the adjustment of the calcium level of the mash-in liquor, and the adjustment of the initial pH of the mash were observed. An optimum mashing procedure suitable for the production of wort from unmalted sorghum was developed. The optimization results suggested that the potential for brewing a high-quality beer from unmalted sorghum could be improved by 1) adjusting the mash-in liquor to give a calcium content of 200 parts per million; 2) adjusting the mash-in pH to 6.5; 3) using a mashing program with temperature–time stands of 50°C $\times$ 50 min, 80°C $\times$ 10 min, 95°C $\times$ 40 min, and 60°C $\times$ 30 min; 4) using a heat-stable α -amylase (120 U/g of grist, added at the end of the 50°C stand), a neutral protease (100 U/g of grist, added at mash-in), and a fungal α -amylase (600 U/g of grist, added at the start of the 60°C stand); and 5) adjusting the pH to 5.5 prior to the 60°C stand.

Ex. 1004, 69.

¹² Goode includes original page numbering at the top of each page and added page numbering at the bottom corner of each page. We cite to the original page numbering herein.

Goode teaches that mashing involves “[a] proper liquefaction step resulting in a low-viscosity mash,” which can be achieved by effective gelatinization, followed “by the addition of a heat-stable α -amylase” and “it becomes *necessary to add commercial proteases in order to produce sufficient FAN* [(free amino nitrogen)].” *Id.* (emphasis added). Goode states “[i]t is necessary to add exogenous proteolytic enzymes to produce a level of FAN that is deemed necessary for a healthy fermentation.” *Id.* at 70.

Goode discloses experiments with a variety of different commercially available proteases.¹³ *Id.* at 70–71 (“Bioprotease (50, 100, and 200 U/g of grist), Fungal Protease (125, 250, and 500 U/g), and Bioprotease Concentrate (200, 400, and 800 U/g)”). In each experiment, a protease was added to milled, “unmalted sorghum grain grist” along with α -amylase at $\sim 50^{\circ}\text{C}$, the temperature was subsequently raised as high as 90°C , followed by a cooling and “mash-off.” *Id.* at 71–72 (*see* Figs. 1, 2). Goode states that, for one of its tested proteases, i.e., Bioprotease, “[a]t temperatures greater than 60°C , the Bioprotease enzyme was inactivated.”¹⁴ *Id.* at 74.

Goode discloses that, for each protease tested, as enzyme levels increased so did the FAN concentration in the resulting mash (and increased

¹³ Goode discloses several exemplary proteases indicated to have temperature optima (for activity) in the range of ~ 50 – 55°C , which, as discussed above at Section I.E, overlaps with WO ’179’s disclosed process step for adding protease during a liquefaction step, i.e., 40 – 65°C . *See* Ex. 1004, 70 (Tables I and II); Ex. 1003, 5:12–17.

¹⁴ Although enzyme inactivation at 60°C is discussed by Goode with regard to Bioprotease, we understand from other evidence, for example, WO ’179, that there are known proteases used in ethanol production that are not inactivated at 60°C and remain active up to temperatures approaching 70°C . *See, e.g.*, Ex. 1006, Fig. 3.

amino acid levels); however, fungal protease produced the most increase in FAN for each dose. *Id.* at 75 (Table VII). Goode also teaches that “the gelatinization temperature range of the sorghum starch samples” is “71–80°C.” *Id.* at 77. Goode indicates that, in consideration of economic concerns, the cost of using added enzymes in the fermentation process is justified because it increases FAN. *Id.* at 73.

G. WO '895

WO '895 is the September 26, 2002 publication of International Patent Application PCT/DK02/00179, which was filed (by Novozymes A/S and Novozymes North America) on March 19, 2002, and claims priority to a series of U.S. Provisional Applications, the earliest of which was filed on March 19, 2001. Ex. 1005, codes (43), (21), (22), (30).¹⁵ Irrespective of its priority claims, WO '895 is prior art to the claims of the '419 patent under 35 U.S.C. § 102(b); this is not disputed by Patent Owner. *See generally* Resp.; Sur-Reply.

WO '895 discloses that its “invention relates to an improved process for producing a fermentation product,” and clarifies that this fermentation product is, in particular, ethanol. Ex. 1005, Abstract, 2:2–5. WO '895 further discloses:

In the first aspect the invention relates to a process for producing a fermentation product, comprising a fermentation step, wherein the fermentation step is carried out in the presence of all of the following enzyme activities:
carbohydrate-source generating enzyme activity, alpha-amylase

¹⁵ WO '895 includes original page numbering at the top of each page and what we understand to be added page numbering at the bottom corner of each page. We cite to the original page numbering herein.

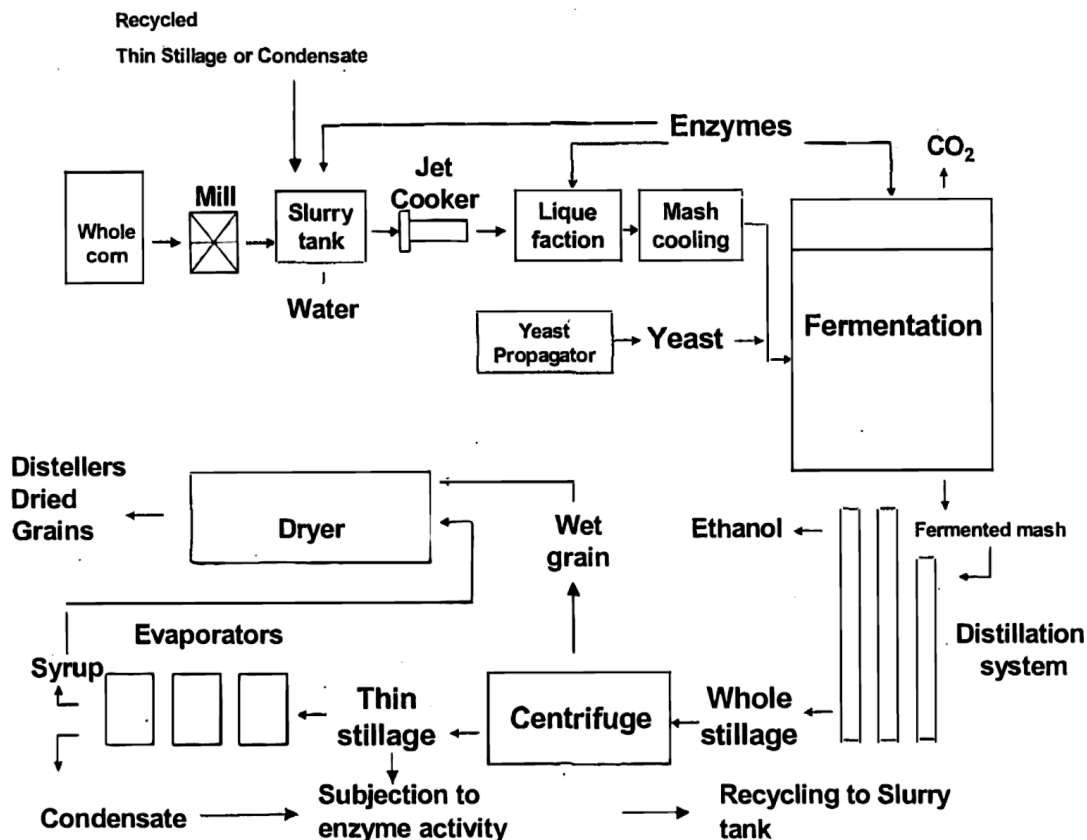
activity, protease activity and debranching enzyme activity and/or one or more yeast cell wall degrading enzymes.

It is to be understood that the enzyme activities may according to the invention be added during pre-saccharification, the propagation of fermenting organism cells and/or later on during the actual fermentation.

Performing the fermentation step in the presence of all the activities of the invention have been shown to result in increased fermentation rate and ethanol yield.

Id. at 2:6–15.

WO '895 discloses the “4 main steps” in ethanol production of milling, liquefaction, saccharification, fermentation, and distillation. *Id.* at 4:1–7. WO '895 provides a flow chart illustrating various stages of ethanol production at its Figure 1, reproduced below:



WO '895 states that “Fig. 1 shows schematically an ethanol production process of the invention.” *Id.* at 1:23. Figure 1 is a flow chart illustrating the progression of “whole corn” to milling, slurring, cooking, liquefaction, and then fermentation, followed by distillation to produce ethanol and byproducts. *See, e.g., id.* at 4:1–6:14. The flow chart shows the addition of “Enzymes” to the “Slurry tank,” “Liquefaction,” and “Fermentation.”

With respect to the first of the aforementioned main steps in ethanol production, WO '895 explains that in milling, raw material, such as whole grain, is milled (wet or dry) to open up the structure and allow further processing, which is “well known in the art.” *Id.* at 4:19–26. WO '895 explains that in liquefaction, milled gelatinized (whole) grain raw material is broken down (hydrolyzed) in to maltodextrins (dextrins), where this hydrolysis can be carried out by acid treatment or using α -amylase, and where the “[m]illed and liquefied whole grains are known as mash.” *Id.* at 4:28–5:8.

WO '895 further explains that saccharification is a process of enzymatic hydrolysis “to produce low molecular sugars DP₁₋₃ (i.e., a carbohydrate source)” from the liquefaction product for fermentation, which is typically done using a glucoamylase. *Id.* at 5:10–14. WO '895 states that “[a] full saccharification step may last up to from 24 to 72 hours, however, it is common only to do a pre-saccharification of typically 40-90 minutes at 30-65°C, typically at about 60°C and then complete saccharification during fermentation (SSF),” where “SSF” refers to simultaneous saccharification and fermentation. *Id.* at 5:17–21. WO '895 further discloses fermenting with a fermenting organism, such as yeast. *Id.* at 5:22–31. Finally, WO '895 states that, “[o]ptionally following the fermentation, the mash may

be distilled to extract the, e.g., alcohol product, in particular ethanol,” which may be used as fuel ethanol, drinking ethanol, spirits, or industrial ethanol. *Id.* at 6:5–10.

WO ’895 states that protease activity can be included in the above-discussed process, particularly during saccharification and/or fermentation. *Id.* at 6:21–7:2. WO ’895 discloses a variety of suitable proteases (derived from fungal and bacterial sources and several commercially available proteases) for its process, which increase “fermentation efficiency” by increasing the FAN (free amino nitrogen) level and, thereby, “increas[ing] the rate of yeast metabolism.” *Id.* at 14:15–15:21; *see also id.* at 17:1–11 (identifying preferred proteases); *see also id.* at 23:15–24:15 (Example 2, which “demonstrates how the presence of *R. miehei* protease increases fermentation rate and ethanol yield.”).

II. DISCUSSION

A. *LEVEL OF ORDINARY SKILL IN THE ART*

Petitioner states,

a person of ordinary skill in the art as of the earliest possible effective filing date of the ’419 patent (February 8, 2005) would have had a Ph.D. or master’s degree in chemistry, chemical engineering, biochemical engineering, agricultural engineering, or a related technical field, with at least two years of experience studying or using proteases or other enzymes in industrial processes such as ethanol production. (Ex. 1002 ¶73.) A person with a lesser amount of education and a greater amount of experience, or vice versa, may also meet the level of ordinary skill. (*Id.*)

Pet. 29–30 (citing Ex. 1002 ¶ 73).

Patent Owner does not address the ordinary level of skill in the art in its Response, but stated in its Preliminary Response that it “does not oppose

use of the Petitioner’s depiction of the level of ordinary skill in the art.” *See generally* Resp.; Prelim. Resp. 27.

We adopt Petitioner’s proposed definition of the skilled artisan, which is not opposed by Patent Owner and appears to be consistent with the level of skill reflected in the prior art of record and the disclosure of the ’419 patent. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (“the prior art itself [may] reflect[] an appropriate level” as evidence of the ordinary level of skill in the art) (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985)).

B. CLAIM CONSTRUCTION

The Board interprets claim terms in an *inter partes* review using the same claim construction standard that is used to construe claims in a civil action in federal district court. 37 C.F.R. § 42.100(b). In construing claims, district courts and the Board here, by default, give claim terms their ordinary and customary meaning, which 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.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Should claim terms require further construction, sources for claim interpretation include “the words of the claims themselves, the remainder of the specification, the prosecution history [i.e., the intrinsic evidence], and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.” *Id.* at 1314 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)). “[T]he claims themselves [may] provide substantial guidance as to the meaning of particular claim terms.” *Id.* However, the claims “do not stand alone,” but are part of “a fully integrated written instrument,”

consisting principally of a specification that concludes with the claims,” and, therefore, the claims are “read in view of the specification.” *Id.* at 1315 (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 978–79 (Fed. Cir. 1995)). Any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Without such a special definition, however, limitations may not be read from the specification into the claims. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

“[W]e need only construe terms ‘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) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). We analyze the parties’ positions on claim interpretation in view of these standards of law.

“The Liquefied Mash”

The only claim language over which there is dispute as to its meaning is “the liquefied mash,” which appears in claim 1 in the clause reciting, “(b) treating the liquefied mash from step (a) with a protease before initiating step (c).”¹⁶ *See* Ex. 1001, 18:47–48.

Patent Owner asserts that “the liquefied mash” means “a solution of dextrans formed when the majority of the starch in the slurry is hydrolyzed by α -amylase.” Resp. 5. Patent Owner also asserts that its “position remains

¹⁶ We note, claim 1’s preceding clause reciting step “(a)” does not provide express antecedent basis for *the liquefied mash* and does not explicitly indicate that a liquefied mash is produced, provided, or present, but this fact is not raised by either party. *See* Ex. 1001, 18:45–46.

that ‘the liquefied mash’ is the material that results from liquefying a slurry of gelatinized starch with α -amylase,” referring to assertions originally presented in the Preliminary Response. *Id.* at 6 (emphasis omitted); *see also* Prelim. Resp. 23–26.

Patent Owner asserts that the ’419 patent’s Specification supports this interpretation where it states “Liquefaction is a process step in which starch-containing material, preferably milled (whole) grain, *is broken down (hydrolyzed) into maltodextrins (dextrins)*,” and:

Liquefaction involves gelatinization of starch simultaneously with or followed by addition of alpha-amylase in order *to degrade starch into dextrins*. When producing ethanol *the liquefied starch-containing material* is saccharified.

Saccharification is a step in which *dextrins* are converted to low molecular DP1-3 sugars that, e.g., can be converted by a yeast into ethanol.

Resp. 9 (quoting Ex. 1001, 4:3–5, 1:46–52 (emphasis Patent Owner’s)).

Patent Owner asserts that “[t]hese passages make clear” that “the liquefied mash” is a solution of dextrins and is produced after a slurry is changed to a solution by α -amylase. *Id.* Patent Owner asserts that this change only occurs “when a majority of the insoluble starch in the slurry has been gelatinized,” at which point it can be liquefied by α -amylase.¹⁷ *Id.* at 9, 31–

¹⁷ Patent Owner explains that the initial gelatinization temperature of a starch marks the start of the gelatinization process where a small fraction of the starch granules are converted and that heating to at least the peak gelatinization temperature gelatinizes a slurry. Resp. 29–30 (citing Ex. 2037, 11–12; Ex. 2011 ¶¶ 111, 141, 149); *see also* Ex. 2011 ¶ 38 (“the initial gelatinization temperature of a given starch type [is] the temperature at which 5% of the starch granules in the slurry . . . have gelatinized”), ¶ 46 (“At various temperatures within the gelatinization temperature range, some granules will be starting to gelatinize and others will be finishing gelatinization”), ¶ 49 (“peak gelatinization temperature” refers to the mid-

32; *see also* Ex. 2011 ¶¶ 58, 103 (identifying that gelatinized starch will be liquefied to water soluble dextrans by α -amylase hydrolysis if the enzyme is present).

Patent Owner's arguments extend across several more pages of the Response and cite additional evidence, including Dr. Kohl's Second Declaration, but the above description well-summarizes Patent Owner's position. *See* Resp. 10–36.

Petitioner did not initially assert that “the liquefied mash” claim language required interpretation. *See* Pet. 30–31. Petitioner does not propose an express construction of “the liquefied mash,” but asserts that, “[i]n claim 1, the liquefied mash refers to the material generated during liquefaction of starch-containing material with an α -amylase in step (a).” Reply 4.

In response to Patent Owner's assertions on this claim language, Petitioner argues that Patent Owner's position and reliance on Dr. Kohl's testimony fails to correctly consider the intrinsic evidence (the claims, the specification, and the prosecution history), because claim 1 does not require producing ethanol or biofuel, or any particular use of the alcohol produced, and is not limited to a commercial process. Reply 2–3 (citing Ex. 1001, 16:38–44, 17:35–42; and also many paragraphs of Ex. 2001 and Ex. 2011).

Petitioner argues that claim 1:

does not require a combination of liquefaction, gelatinization, and additional process conditions (e.g., converting a “majority”

point of gelatinization where 50% of the starch granules have gelatinized), ¶ 98 (showing the gelatinization temperature ranges for several starches), ¶ 101 (reaffirming the meanings of initial gelatinization temperature (2–5% gelatinization) and mid-point (50% gelatinization)).

of starch and forming a “solution”) nowhere described in step (a). Ex. 1020, ¶¶19-28. Indeed, claim 1 contains no gelatinization step and does not require using any particular temperature, much less high temperatures necessary to gelatinize starch.

Id. at 4. Petitioner argues that claim 2, which depends from claim 1, makes clear that claim 1’s steps (a) and (b) can be performed simultaneously and argues that claim 14 requires that the protease treatment of step (b) (which may be simultaneous with step (a)) be carried out at a temperature of 25–90°C, which includes temperatures below any starch’s gelatinization temperature, indicating that the liquefying step may also take place at such lower temperatures. *Id.* at 4–5 (citing Ex. 1001, 4:31–36; Resp. 58–59); *see also* Ex. 1001, 18:54–55 (claim 2), 19:13–14 (claim 14). Petitioner’s point is that claim 1 cannot be narrower in scope than these dependent claims so as to require a gelatinization step be read into claim 1’s step (a) or inserted before step (a) or between steps (a) and (b). *Id.* at 5 (citing *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1242 (Fed. Cir. 2003)).

Upon considering the parties’ arguments and the evidence of record, we find that the claim term *the liquefied mash* need not be expressly interpreted to have a definition other than its ordinary meaning as it would have been understood by the person of ordinary skill in the art. *Phillips*, 415 F.3d at 1312–13. We find the intrinsic record, the Specification, in particular, identifies the ordinary meaning of this common term where it states “[m]illed and liquefied whole grains are known as mash,” referring to liquefied mash. Ex. 1001, 4:59. This well-summarizes the meaning of the claim language. This could well be the end of our analysis on this claim language; however, because it is the primary focus of Patent Owner’s arguments in this proceeding, it is useful to further discuss the language.

The term *liquefied mash* and the process of liquefying starch-containing material, or liquefaction, (as a part of and in the context of a fermentation or alcohol production process) were discussed by both the Examiner and Patent Owner throughout the prosecution of the '419 patent's application, and neither expressed any need to explain the meaning of such language. *See, e.g.*, Ex. 1011, 156, 183, 196, 220 *et seq.* (office actions and amendments/responses). This supports the conclusion that the ordinary and customary meaning of the term “the liquefied mash” would have been well-understood by the skilled artisan in the context of the claims.

Further considering the intrinsic record, the Federal Circuit explained the doctrine of claim differentiation as follows:

In the most specific sense, “claim differentiation” refers to the presumption that an independent claim should not be construed as requiring a limitation added by a dependent claim. *See Nazomi Commc'ns, Inc. v. Arm Holdings, PLC.*, 403 F.3d 1364, 1370 (Fed. Cir. 2005) (“[C]laim differentiation ‘normally means that limitations stated in dependent claims are not to be read into the independent claim from which they depend.’” (quoting *Karlin Tech., Inc. v. Surgical Dynamics, Inc.*, 177 F.3d 968, 971–72 (Fed. Cir. 1999))); *see also Phillips*, 415 F.3d at 1314–15 (explaining the presumption without invoking the “claim differentiation” label). Thus, the claim differentiation tool works best in the relationship between independent and dependent claims. *See Liebel–Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004) (citing *Sunrace Roots Enter. Co. v. SRAM Corp.*, 336 F.3d 1298, 1302–03 (Fed. Cir. 2003)).

Curtiss-Wright Flow Control Corp. v. Velan, Inc., 438 F.3d 1374, 1380 (Fed. Cir. 2006) (reading additional limitation from dependent claim into independent claim makes that additional limitation superfluous and might render dependent claim invalid) (alteration in original).

The '419 patent's claim 2, which depends from independent claim 1, well-summarizes the scope to be assigned claim 1's steps (a) and (b)—as claim 2 depends directly from claim 1, it illuminates the scope of claim 1 because, under the doctrine of claim differentiation, it is presumed that claim 2 adds a limitation claim 1 encompasses but does not require.¹⁸ Claim 2 recites “[t]he process of claim 1, wherein steps (a) and (b) are carried out simultaneously or sequentially.” Ex. 1001, 18:54–55; *see also id.* at 18:43–53 (claim 1). The '419 patent specifies that “the protease treatment may advantageously be carried out simultaneously with liquefaction.” *Id.* at 3:38–40; *see also id.* at 5:37–40 (“It should be understood that degradation of protein contained in the starch-containing material may be initiated (by addition of protease) at any time during liquefaction, such as for instance to the aqueous slurry prior to step (a).”). This establishes that the scope of claim 1 encompasses the narrower process of claim 2 where the claimed step of treating liquefied mash with protease happens simultaneously with the claimed step of liquefying the starch-containing material with α -amylase (to produce that liquefied mash). *See id.* at 3:38–40, 4:61–6:40, 16:35–18:41 (describing both sequential and simultaneous liquefaction and protease treatment steps).

Further, dependent claim 8 also illuminates the meaning of the language of claim 1, from which it depends via its dependence on claim 7. Claim 8 recites “[t]he process of claim 1, wherein the slurry [(which claim 7

¹⁸ We take no position on whether claim 1 embraces a process wherein a step intervenes steps (a) and (b). That claim 2 may merely make explicit, rather than limit, the entirety of timing options encompassed by claim 1 (i.e., simultaneous or sequential addition), does not change our analysis.

defines as being formed by milling the starch-containing material and mixing with water)] is heated to above the initial gelatinization temperature.” *Id.* at 19:1–2; *see also id.* at 18:43–53 (claim 1), 18:63–67 (claim 7). “[T]he presence of a dependent claim that adds a particular limitation,” here, heating a starch-containing slurry above initial gelatinization temperature, “gives rise to a presumption that the limitation in question is not present in [(required by)] the independent claim.” *Phillips*, 415 F.3d at 1314. “[W]here[,], [as here,] the limitation that is sought to be ‘read into’ an independent claim already appears in a dependent claim, the doctrine of claim differentiation is at its strongest.” *Liebel-Flarsheim*, 358 F.3d at 910 (citing *Sunrace Roots*, 336 F.3d at 1302–03). This is exactly what Patent Owner asks—that we interpret claim 1 to additionally require heating the pre-liquefied starch-containing material above its initial gelatinization temperature.

Under the doctrine of claim differentiation, it is presumed that claim 8 adds this limitation of heating a slurry of starch-containing material (claim 7’s slurry) to above the initial gelatinization temperature, which is within the scope of, but not required by claim 1. “The inclusion of such a specific limitation . . . in claim [8] makes it likely that the patentee did not contemplate that [claim 1] already contained that limitation” because an independent claim should be given broader scope than a dependent claim to avoid rendering the dependent claim redundant. *Phillips*, 415 F.3d at 1324; *see also* 35 U.S.C. § 112(d) (2018) (“a claim in dependent form shall contain a reference to a claim previously set forth and then *specify a further limitation of the subject matter claimed*” (emphasis added)). Thus, claim 1 is presumed to have a scope broader than claim 8, i.e., the starch-containing

material recited by claim 1 (formed into a slurry per claim 7) *may* be heated above its initial gelatinization temperature (after milling and slurring per claim 7), but its scope is broader and such a heating step *is not required*. Otherwise, claim 8 would be superfluous.

The '419 patent nowhere states that heating a slurry of starch-containing material above its initial gelatinization temperature is always required; it may customarily be the case, but is not identified as required. Ex. 1001, 1:44–49 (liquefaction involves gelatinization of starch with or followed by addition of α -amylase), 4:1–8 (discussing liquefaction of milled (whole) grain by hydrolyzing, but not mentioning gelatinization or heating), 4:21–30 (describing “a particular embodiment” including heating the slurry to above the initial gelatinization temperature), 16:35–18:41 (describing specific examples, but remaining vague regarding whether the a slurry was heated to above an initial gelatinization temperature).

We conclude that, other than the use of α -amylase, how the recited starch-containing material becomes *the liquefied mash* is not a part of the definition of the term *the liquefied mash*. Whether omitting a gelatinization step would foreclose a slurry (milled and hydrated grain) from becoming a *liquefied mash* is not a question for interpreting the term *liquefied mash* so much as it is a question for whether a process, for example, as taught in the prior art, results in *liquefied mash*. “[W]hile it is true that claims are to be interpreted *in light of* the specification . . . , it does not follow that limitations from the specification may be read into the claims. . . . [T]he claims define the invention.” *Sjolund v. Musland*, 847 F.2d 1573, 1581–82 (Fed. Cir. 1988). Thus, we will not read into the claims an additional step that is described in the written description, but not expressly recited by the claims.

We further decline to read into the claim term “the liquefied mash” a requirement that “a solution of dextrans” be formed and that “the liquefied mash” is only present when “the majority of the starch in the slurry is hydrolyzed by α -amylase,” as urged by Patent Owner.

We discern nothing in the ’419 patent itself or its prosecution history that requires reading these added elements into the claims. The Specification indicates that α -amylase degrades gelatinized starch into dextrans; it does not say that a “solution” is formed or required. *See* Ex. 1001, 1:45–48, 4:3–5, 4:47–58; *see also* Ex. 1020 ¶¶ 38–42 (Dr. Clark discussing this issue). We discern nothing in the prosecution history that alters our understanding based on the written description or words of the claims. *See generally* Ex. 1011.

Further, we discern nothing in the intrinsic record that suggests Patent Owner’s proposed claim requirement that a *majority* of starch in a slurry be hydrolyzed by α -amylase before *the liquefied mash* is present. The ’419 patent itself does not once use the term “majority” and nowhere indicates any requirement for how much starch must be liquefied before a protease can act thereon. *See generally* Ex. 1001. Claim 1 expresses no limitations directed to how much liquefied mash is produced, provided, or treated; such concepts are not even mentioned. *Id.* at 18:43–54. The record does not support that some sea change occurs in a slurry of starch-containing material at the point when it transitions from 49.9% liquefied to 50.1% liquefied. Patent Owner’s proposal that a majority of the starch-containing material must first be liquefied by α -amylase before there is any liquefied mash present to be treated by protease is in direct conflict with the (claimed) embodiments of the ’419 patent where liquefaction and protease treatment

occur simultaneously. Nowhere does the '419 patent indicate that a majority of starch must be liquefied before protease treatment occurs; Patent Owner's proposed construction is inconsistent with the evidentiary record, in particular, the language used in the challenged claims.

Dr. Kohl (Patent Owner's witness) explains that "[s]tarch within a slurry will gelatinize over a range of temperatures," where "less stable starch granules gelatinize at lower temperatures and more stable granules will gelatinize at higher temperatures." Ex. 2011 ¶ 30. Dr. Kohl further explains that there are temperature-related starting and ending points for gelatinization of starch in a sample, where when the starch sample reaches an initial gelatinization temperature 2–5% will gelatinize, when the starch sample reaches its midpoint, or peak, gelatinization temperature 50% of the granules have gelatinized, and when the starch sample reaches its final gelatinization temperature 95–98% has gelatinized. *Id.* ¶¶ 36, 46 ("At various temperatures within the gelatinization temperature range, some granules will be starting to gelatinize and others will be finishing gelatinization.").

Based on that testimony, which is credible, we find that conversion of starch material (i.e., a slurry) to a *liquefied mash* is not a binary process akin to flipping a switch where at one moment an entire sample is a suspension of solid starch particles and the next moment it is all a liquefied mash, but instead the sample transitions to a liquefied mash as the starch is acted upon by α -amylase, bit by bit. *See, e.g., id.* ¶ 51 ("A skilled person would expect that a majority (at least 50%) of the starch granules in a sample of starch heated in excess water will have gelatinized at or slightly above (2–5%) the peak temperature for the sample.").

Thus, we find unpersuasive Patent Owner’s argument and evidence (for example, other portions of Dr. Kohl’s testimony, e.g., Ex. 2011 ¶¶ 102–110, 125–130, 143, 146–152) that the claims require either forming a solution or hydrolyzing a majority of a slurry’s starch by α -amylase. Patent Owner’s evidence does not support that such elements should be read into the claims and is inconsistent with other of Patent Owner’s evidence and other evidence of record. We will not read such limitations into the claims.

Most importantly, although we do not agree with Patent Owner’s positions on the meaning of the claim term “the liquefied mash,” ultimately, our findings regarding the prior art and our conclusions on patentability of the claims would not change even were we to adopt Patent Owner’s proposed construction of *the liquefied mash*, i.e., even if gelatinization of the starch-containing material were necessary so that α -amylase hydrolyzes a majority of it to a solution of dextrins.¹⁹ See *Nidec*, 868 F.3d at 1017 (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”). We explain further below.

To reiterate, “Patent Owner’s position remains that ‘the liquefied mash’ is the material that results from liquefying a slurry of gelatinized starch with α -amylase. The ‘liquefied mash’ is thus the solution of dextrins formed when the majority of starch in the slurry is hydrolyzed by

¹⁹ Patent Owner’s argument that gelatinization is a part of liquefying a starch-containing slurry appears to be, at least in-part, agreed-to by Petitioner, which states “[a] starch slurry is initially gelatinized by cooking at high temperature and is then liquefied (broken down into smaller carbohydrates and dextrins) by treatment with α -amylase to form a mash. (Ex. 1002, ¶21.).” Pet. 8. However, as we explain *infra*, whether or not gelatinization is required is not determinative here because it occurs under the conditions disclosed in the prior art.

α -amylase.” Resp. 6 (emphasis omitted). We find that even if gelatinization were a necessary event preceding the claimed liquefying starch-containing material with α -amylase, which according to Patent Owner produces *the liquefied mash*, WO ’179 asserted by Petitioner as anticipating claim 1 of the ’419 patent provides the following pertinent disclosures that make Patent Owner’s proposed added claim limitations immaterial:

(1) “a process . . . for enzymatically releasing freely available nitrogen from cereals containing high amounts of glutelin and/or prolamin, comprising the step of **adding to** the grains, or **a liquefied mash obtained from said grain**, a combination of **an endoprotease and an exo-peptidase**.” (Ex. 1003, 3:10–13 (emphasis added));

(2) “In the liquefaction process a number of steps are usually carried out at elevated temperature: after **adding α -amylase and protease** the mixture [(i.e., a hydrated ground cereal flour with 4:1 parts water)] is maintained at a temperature between about **40°C and 65°C**, preferably between about 45 and 55°C, most preferably 50°C, **until a sufficient liquefaction is obtained**. The time needed depends on the cereal or mixture of cereals used, but usually from about 30 minutes till about 2 hours is satisfactory.” (*id.* at 4:27–17 (emphasis added)); and

(3) “[a] process for enzymatically releasing freely available nitrogen from cereals containing high amounts of glutelin and/or prolamin, comprising the step of **adding to** the grains, or **a liquefied mash obtained from said grain**, a combination of **an endoprotease and an exo-peptidase**” (*id.* at 27:6–9 (claim 12) (emphasis added); *see also id.* at 6:13–21).

See Pet. 7, 11–17, 31–54, 57–62, 64–65 (citing various parts of Ex. 1003); *see also* Ex. 1003, 22:1–23:19 (Examples 7 and 8, which disclose heating (at 1°C/min.) ground barley flour suspended in excess water (57g per 300 ml) to 63°C (well in excess of barley’s final gelatinization temperature according to Dr. Kohl (Ex. 2011 ¶ 98)) and maintaining that temperature for 30 minutes

in the presence of B.A.T.S. α -amylase, Brewers Protease 2000, and exopeptidase, followed by more heating then cooling, resulting in measureable soluble proteins). Each of these disclosures by this prior art reference evidences a *liquefied mash* is produced from starch-containing material and is treated with protease.

As explained by Dr. Kohl:

[I]f both the α -amylase and the protease are thermostable at the temperatures used to gelatinize the starch, the protease treatment step can be performed simultaneously with liquefaction because both enzymes will be able to withstand the heat required for gelatinization. This is illustrated in Example 2 of the '419 Patent. *See* '419 Patent (Ex. 1001) at 17:30-18:41.

Ex. 2001 ¶ 26.

This is also precisely the process disclosed by WO '179: gelatinization of a slurry of starch-containing material, simultaneously subjected to α -amylase and protease. WO '179 discloses that the grains (starch-containing material) it teaches converting to ethanol can be cereals such as sorghum, *corn*, *barley*, rice, *wheat*, *oat*, and mixtures thereof. Ex. 1003, 2:11–18, 4:6–10. Dr. Kohl confirms that for corn the initial gelatinization temperature is 62°C and the midpoint gelatinization temperature is 67°C, for wheat these temperatures are 58°C and 61°C, and for barley these temperatures are 51.5°C and 57°C. Ex. 2011 ¶¶ 98, 101 (explaining that “the initial gelatinization temperature is where 2–5% of the granules will gelatinize, while the mid-point is where half (50%) will [have] gelatinized.”); *see also* Ex. 1010, 12; Ex. 1007, 164–65 (disclosing low gelatinization temperatures for wheat and oats). Dr. Kohl provides a table of several starches' gelatinization temperatures, including these, which we reproduce, in-part, below:

Table III
Kofler Gelatinization Temperatures of Various Starches
(Initiation, Midpoint, and Completion in °)

<i>Unmodified Starches</i>			
Corn	62–67–72	Waxy maize	63–68–72
Sorghum	68–73.5–78	Waxy sorghum	67.5–70.5–74
Wheat	58–61–64	Barley	51.5–57–59.5
Tapioca:		Rye	57–61–70
Brazilian	49–57–64.5	Pea (green garden)	57–65–70
Dominican	58.5–64.5–70	Rice	68–74.5–78
Siamese	62–68–73	High-amylose corn	67–80–? ^a
Potato	50–63–68		

Id. (citing Ex. 2027, 668 (Table III)). Other of Patent Owner’s evidence indicates that oat has an initial gelatinization temperature of 53°C and a final/completion gelatinization temperature of 59°C. Ex. 2030, 5571 (Table 1).

Patent Owner’s evidence makes clear that, for several of the starches disclosed as used in the processes of WO ’179, i.e., wheat, barley, and oat, *complete gelatinization* occurs under the conditions disclosed by the reference and for corn (a common starch for producing alcohol and the starch disclosed in the ’419 patent’s examples) *at least some gelatinization* would occur. Furthermore, WO ’179 makes clear that the heating of ground starch in excess water to above gelatinization temperatures occurs in the presence of α -amylase and protease. *See, e.g.*, Ex. 1003, 4:23–5:17. Moreover, WO ’179 expressly states that this process obtains sufficient liquefaction of the starch and calls the liquefied product “a liquefied mash.” *Id.* at 2:21–22, 3:12–13, 4:24–25, 5:15. There is no dispute that the thermostable α -amylases of WO ’179 (e.g., Gist-Brocades’s commercially available Brewer’s Amyliq Thermo Stable (B.A.T.S.) derived from *bacillus licheniformis*) are active at 65°C, and Dr. Kohl confirmed that the proteases

of WO '179 are active at 65°C. Ex. 2001 ¶¶ 51–53 (referencing Ex. 1003, Fig. 3). Thus, it is immaterial to our ultimate decision, which would not change if Patent Owner’s claim construction were adopted, whether gelatinization is a necessary part of the claimed “liquefying said starch-containing material” to produce “the liquefied mash” because the prior art teaches the conditions for producing the liquefied mash, as claimed, and that it is produced.

For the reasons above, we conclude the claim language *the liquefied mash* needs no express interpretation to ultimately resolve this *inter partes* review and, therefore, we assign no specific meaning to this claim language other than its ordinary meaning as would have been understood by the person of ordinary skill in the art.

C. APPLICABLE LEGAL STANDARDS

As noted above, “[i]n an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (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”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware*, 800 F.3d at 1378 (discussing the burden of proof in *inter partes* review).

Regarding anticipation, our reviewing court has held:

In order to anticipate the claimed invention, a prior art reference must “disclose all elements of the claim within the four corners of the document,” and it must “disclose those elements ‘arranged as in the claim.’” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)).

Microsoft Corp. v. Biscotti, Inc., 878 F.3d 1052, 1068 (Fed. Cir. 2017); *see also Purdue Pharma L.P. v. Epic Pharma, LLC*, 811 F.3d 1345, 1358–59 (Fed. Cir. 2016) (distinct, but directly related disclosures of a reference may be combined in an optional, anticipating embodiment, e.g., a controlled-release pharmaceutical formulation specifically disclosed as an embodiment with claimed components *directly relates* to a disclosed list of therapeutic compounds *useable therewith*).

Regarding obviousness, the Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), reaffirmed the framework for determining obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The *KSR* Court summarized the four factual inquiries set forth in *Graham* (383 U.S. at 17–18) that are applied in determining whether a claim is unpatentable as obvious under 35 U.S.C. § 103(a) as follows:

(1) determining the scope and content of the prior art; (2) ascertaining the differences between the prior art and the claims at issue; (3) resolving the level of ordinary skill in the pertinent art; and (4) considering objective evidence indicating obviousness or non-obviousness. *KSR*, 550 U.S. at 406. “The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *Id.* at 416. “[W]hen the question is whether a patent claiming the combination of elements of prior art is obvious,” the answer depends on “whether the improvement is more than the predictable use of prior art elements according to their established functions.” *Id.* at 417.

With these standards in mind, and in view of the definition of the skilled artisan and claim interpretation discussed above, we address Petitioner’s challenges below.

D. ANTICIPATION OF CLAIMS 1–7, 11, 14, 15, 17, AND 18 BY WO ’179

1. THE PARTIES’ POSITIONS

Petitioner asserts that “[c]laims 1–7, 11, 14, 15, 17, and 18 of the ’419 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by WO ’179.” Pet. 31. Petitioner introduces this reference, stating “[a] 1997 published patent application, WO ’179, reports that adding a protease during liquefaction, before saccharification, achieves many benefits including increased freely available nitrogen (‘FAN’), which is important for efficient fermentation and ethanol production (Ex. 1003[])” and also, “[a]s Dr. Clark explains, WO ’179 expressly discloses adding a protease to liquefied mash before the saccharification step of an ethanol production process, anticipating claims 1–7, 11, 14, 15, 17, and 18 of the ’419 patent.” *Id.* at 2–3; *see also id.* at 12–17 (discussing the known advantages of and processing parameters for adding proteases during liquefaction, as taught in WO ’179; citing, *inter alia*, Ex. 1003, Abstract, 1:8–12, 1:15–19, 2:13–16, 2:19–30, 2:31–3:2, 3:10–16, 4:2–17, 5:3–7, 6:3–5, 6:13–27, 7:10–23, 12:1–21:22 (Examples 1–6), 26:4–10 (claim 1), 27:11–13 (claim 13); Ex. 1002 ¶¶ 31–45).

In addressing independent claim 1, Petitioner identifies the claim’s four recited process steps, (a)–(d), noting that steps (a) and (b) may occur either simultaneously or sequentially (as expressly set out by dependent claim 2), and identifies how and where WO ’179 discloses a process including the claimed steps.²⁰ *Id.* at 31–35 (citing Ex. 1001, *inter alia*,

²⁰ *See supra* Sections I.C and I.E (discussing the ’419 patent and WO ’179, and reproducing challenged claim 1) and Section II.B (discussing claim construction and WO ’179’s disclosure of creating a liquefied mash and treating it with protease).

18:43–53; Ex. 1002 ¶¶ 77–132; Ex. 1003, generally, and specifically at 1:8–19, 2:19–22, 3:7–9, 3:14–16, 5:3–15, 5:19–25, 5:30–6:2, 7:1–9, 7:11–17, 7:19–23, 12:1–21:22 (Examples 1–6), 26:1–27:13); *see also id.* at 14–17 (discussing the disclosure of WO ’179 and further citing Ex. 1003, 2:23–30, 3:10–13, 4:2–5, 6:13–18, 6:22–24; Ex. 1002 ¶¶ 34–45).

For each of the ’419 patent’s dependent claims 2–7, 11, 14, 15, 17, and 18, Petitioner likewise identifies their respective additional limitations and identifies how and where WO ’179 discloses the additional subject matter.²¹ *Id.* at 35–41 (citing Ex. 1003, 1:10–12, 1:20–2:5, 2:19–22, 4:27–5:15, 5:31–6:1, 6:15–18, 7:1–23, 12:1–21:22 (Examples); Ex. 1002 ¶¶ 92–131; Ex. 1005, 3:27–32 (as support that alcohol is produced as beverage or biofuel), 6:5–10 (as support that ethanol/alcohol production necessarily involves distillation); Ex. 1010, ix–x (as support that ethanol/alcohol production necessarily involves distillation), 1–7 (as support that alcohol is produced as beverage or biofuel), 9 (as support that grinding means milling); Ex. 1001, 6:64 (as support that grinding means milling), 7:62–64 (as support that protease derived from *Bacillus amyuloliquefaciens* is suitable), 9:1–2 (as support that α -amylase derived from *Bacillus licheniformis* is suitable)).²²

²¹ We note, for claim limitations involving ranges, Petitioner cites *Ineos USA LLC v. Berry Plastics Corp.*, 783 F.3d 865, 869 (Fed. Cir. 2015) (“When a patent claims a range, . . . that range is anticipated by a prior art reference if the reference discloses a point within the range.”). *See* Pet. 37, 39–41.

²² Regarding citations to references other than WO ’179 under its anticipation ground, Petitioner cites *Monsanto Tech. LLC v. E.I. DuPont de Nemours & Co.*, 878 F.3d 1336, 1345 (Fed. Cir. 2018) (extrinsic evidence may be used to interpret an anticipating reference and to shed light on what it would have meant to a skilled artisan). *See* Pet. 38.

Patent Owner argues that WO '179 does not anticipate because it does not describe treating liquefied mash with a protease, but describes “treating the slurry with a protease” because the protease of WO '179’s process would not be active when the liquefied mash forms “(*i.e.*, after the temperature is raised to 90-95°C and held for 30-60 minutes).” Resp. 37. Patent Owner argues that, contrary to the Board’s determinations as expressed in the Institution Decision, WO '179 does not describe heating a slurry of corn, barley, or wheat to 65°C in the presence of α -amylase, that such starches are gelatinized and liquefied, and that this product is treated with a protease. *Id.* at 40 (citing DI 33–43). Patent Owner argues that the starch material is heated only to 50°C in the presence of protease because that is an optimal activity temperature and Goode evidences that proteases are inactivated above 60°C. *Id.* at 40–41 (citing Pet. 35–36, 39, 57–58, 60; Ex. 1002 ¶¶ 118, 125, 188; Ex. 2011 ¶¶ 182–185 (Patent Owner actually cites Ex. 2001, but we understand this to be a typographical error as Ex. 2001 has only 90 paragraphs); Ex. 1004, 74). Patent Owner also goes on to argue that, for a variety of reasons, heating starch material in this way, to below the starch’s gelatinization temperature in the presence of a protease or, alternatively, heating to high temperatures above 90°C in the presence of a protease, would not achieve the results needed to meet the claimed step of treating the liquefied mash with a protease. *See id.* at 41–59 (citing Ex. 2001 ¶¶ 26, 41–43, 48–56 (again, at times, Patent Owner appears to conflate Exhibits 2001 and 2011; however, we have considered each); Ex. 2011 ¶¶ 40, 77–78, 82, 86, 88–90, 92, 111, 127, 133, 140–141, 149, 151–158, 161, 166, 168–170, 175–180, 195, 198–200, 202–206, 218–219, 269–277; and also citing Ex. 1001, 4:39–43; Ex. 1002 ¶¶ 21, 118, 182–183; Ex. 1003,

4:27–5:11, 5:15–27, 5:30–6:9, 7:1–23, 11:8–13, 12:6–20; 17:25–18:14, Fig. 3; Ex. 1004, 70, 74; Ex. 1009 ¶¶ 4–7, 9; Ex. 2010, 621; Ex. 2020, 446–47; Ex. 2031, 173; Ex. 2033, 716–18; Ex. 2034, 7:20–22; Ex. 2036, 277, 284; Ex. 2037, 12–14; Ex. 2043, 291–92; Ex. 2060, 480; Ex. 2070).

Patent Owner also argues that WO '179's disclosures at "disparate sections" are not properly connected to one another to make a case for anticipation. *Id.* at 43 (citing *Net MoneyIN*, 545 F.3d at 1370 (citing *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458–59 (Fed. Cir. 1984) (no anticipation because of improper "treat[ment of] the claims as mere catalogs of separate parts, in disregard of the part-to-part relationships set forth in the claims and that give the claims their meaning"))).

Patent Owner does not separately address Petitioner's arguments that WO '179 anticipates dependent claims 2–7, 11, 14, 15, 17, and 18. *See* Resp. 37–59; *see generally* Sur-Reply.

As explained below, we are convinced by Petitioner's assertions and the evidence of record that WO '179 anticipates claims 1–7, 11, 14, 15, 17, and 18 of the '419 patent and, recognizing that Petitioner always has the burden of proof here, Patent Owner's arguments do not persuade us otherwise.

2. ANALYSIS

As discussed in further detail below, we find that Petitioner has shown by a preponderance of the evidence that independent claim 1 is anticipated by WO '179. As noted above, the Petition sets forth how and where WO '179 discloses a process including each step recited by claim 1. Pet. 14–17 (citing Ex. 1003, 1:8–12, 1:15–19, 2:19–30, 3:10–13, 4:2–5, 7:10–23,

6:3–5, 6:13–15, 6:22–24, 13:1–13, 14:13–17:22, 17:24–18:14 (Table 10), 17:28–30, 26:4–10 (claim 1), 27:11–13 (claim 13); Ex. 1002 ¶¶ 34–45); *id.* at 31–35 (further citing Ex. 1001, 4:61–5:41, 5:48–54, 7:38–39, 7:62–64, 8:23–32, 11:25–44, 16:37–18:28 (Examples 1 and 2), 18:54–55 (claim 2); Ex. 1003, 1:8–19, 2:19–22, 3:7–9, 3:14–16, 5:3–15, 5:23–24, 5:30–6:2, 6:13–21, 7:1–9, 7:11–17, 7:19–23, 12:1–21:22 (Examples), 26:1–27:13 (claims 1–13); Ex. 1002 ¶¶ 77–132; and also invoking by internal reference to Pet. § VIII: Ex. 1001, 7:36–39, 18:43–53 (claim 1); Ex. 1002 ¶¶ 74). We review the prior art’s relevant disclosure, as identified by Petitioner in the Petition, below.

As its preamble, claim 1 recites “[a] process for producing an alcohol from starch-containing material, comprising,” which is followed by the body of the claim reciting process steps. Ex. 1001, 18:43–44. We note, the preamble includes the open and inclusive transitional term “comprising,” which means the claim can include additional steps or elements not expressly recited therein. *CIAS, Inc. v. Alliance Gaming Corp.*, 504 F.3d 1356, 1360 (Fed. Cir. 2007) (“In the patent claim context, the term ‘comprising’ is well understood to mean ‘including but not limited to.’”). “Generally, the preamble does not limit the claims.” *Allen Eng’g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1346 (Fed. Cir. 2002). Regardless of whether the preamble is limiting, Petitioner sufficiently shows that the recitation in the preamble is satisfied by the prior art because WO ’179 is directed to a process for producing alcohol, for example, drinkable ethanol, from starch-containing cereal grains. Pet. 32; Ex. 1003, Abstract, 1:8–12, 1:30–32, 2:11–3:16; *see also* Ex. 1002 ¶¶ 77–79.

Following its preamble, claim 1 recites “(a) liquefying said starch-containing material with an alpha-amylase,” and next recites “(b) treating the liquefied mash from step (a) with a protease before initiating step (c),” where “step (c)” is a saccharification step. Ex. 1001, 18:45–51. Petitioner identifies step “(a)” as disclosed as a part of WO ’179’s alcohol production process and further, regarding step “(b),” that “WO ’179 expressly discloses adding a protease (endoprotease and/or exoprotease) to the liquefied mash before initiating saccharification.” Pet. 32–33 (citing Ex. 1003, 2:19–22, 5:3–15, 17:27–28, 18:19–20, 20:17–18; Ex. 1002 ¶¶ 81–85). Whether WO ’179 discloses this subject matter is vigorously contested by Patent Owner, which argues that the reference does not teach that the claimed liquefied mash exists at the right time for protease treatment. But as discussed above in our claim construction analysis, we reject Patent Owner’s arguments on this issue and, as discussed above and further below, find WO ’179 teaches liquefying starch-containing material with α -amylase and treating the resultant liquefied mash with a protease. *See supra* Section II.B (claim construction section). We determine and conclude that, whether or not gelatinization is a required part of or preceding step for the claimed liquefaction step “(a),” that the prior art discloses the process. The respective challenged claims are anticipated both under the ordinary meaning of “the liquefied mash” and under Patent Owner’s argument that gelatinization is required.

We find WO ’179 discloses, repeatedly, that its alcohol production methods include liquefaction of cereal, starch-containing material using α -amylase to obtain liquefied mash, where that liquefied mash is produced in the presence of and treated by protease, before proceeding to a

saccharification step, and then a fermentation step. *See* Ex. 1003 (all following emphasis added), Abstract (“The invention provides a process for the production of a fermentable wort from cereal grains, comprising the steps of: (a) *liquefaction of cereal material*, with the *aid of α -amylase and/or endoprotease activity, to obtain a liquefied mash;*”), 2:19–22 (“the invention provides a process for the production of a fermentable wort from cereal grains, comprising the steps of: (a) *liquefaction of cereal material*, with the *aid of α -amylase and/or endoprotease activity, to obtain a liquefied mash;*”), 2:33–3:2 (“It is found to be very advantageous according to the invention when *the exopeptidase [(a protease)] is present during the liquefaction of the cereal grains.*”), 3:10–13 (“[A] process is provided for *enzymatically releasing freely available nitrogen from cereals* containing high amounts of glutelin and/or prolamin, comprising the step of *adding to* the grains, or *a liquefied mash obtained from said grain*, a combination of *an endoprotease and an exo-peptidase.*”), 4:23–26 (“*Apart from the addition of exopeptidases*, the preparation of the wort, for example for brewing beer, may be *carried out as usual*. Generally, it comprises the *liquefaction of the cereal raw material to obtain a mash*, followed by saccharification of the mash to obtain a wort.”), 6:3–5 (“It was found that the *use of exo-peptidase* during the preparation of wort, for example for brewing beer, is *especially advantageous during the liquefaction step* of the cereal raw material.”), 6:22–24 (“[I]t is found that organoleptic properties (taste and smell) of beers produced from wort *wherein exo-peptidases have been used in the liquefaction step* or the saccharification step (or both), are improved.”), 7:4–5 (“The *α -amylase used in the liquefaction step* of the process according to the invention is generally an enzyme which cleaves

α -1,4-glucose-glucose bonds in starch.”), 7:11–13 (“The *endoprotease used in the liquefaction step* of the process according to the invention is generally an enzyme which cleaves peptide bonds in proteins under pH and temperature conditions of the beginning of a liquefaction step (pH 5–6; t° 45–55°C).”), 7:20–21 (“The *exo-peptidases used in the liquefaction step* of the process according to the invention are generally enzymes which cleave N-terminal bonds of peptides or proteins.”), 26:4–6 (claim 1: “1. A process for the production of a fermentable wort, comprising the steps of: (a) *liquefaction of cereal material, with the aid of α -amylase and/or endoprotease activity, to obtain a liquefied mash . . .*”), 27:6–9 (claim 12: “12. A process for enzymatically releasing freely available nitrogen from cereals containing high amounts of glutelin and/or prolamin, comprising the step of *adding to* the grains, or *a liquefied mash obtained from said grain, a combination of an endoprotease and an exo-peptidase.*”).

This repeated disclosure by WO '179 of liquefying starch using α -amylase to obtain liquefied mash and treating it with protease is analyzed and discussed by Dr. Clark, who confirms it as teaching the relevant limitations of claim 1. *See* Ex. 1002 ¶¶ 20–21 (discussing the general steps of ethanol production), ¶¶ 23–26 (discussing what proteases are and how they function), ¶¶ 29, 35–44, 80–85, 90 (discussing WO '179 and its disclosed use of α -amylase in liquefying starch-containing material and the use of protease to treat the liquefied mash); *see also* Pet. 14–17, 31–41 (discussing WO '179 as its disclosure applies to the '419 patent's claimed subject matter).

Patent Owner's arguments over Petitioner's Ground 1 ask us to overlook all this disclosure of WO '179 or consider it incorrect. *See, e.g.,*

Resp. 37–38. Further, Patent Owner’s arguments also ask us to overlook that the disclosure of WO ’179 very closely parallels (in methods and materials) the written description of the ’419 patent’s Specification describing its “Simultaneous Liquefaction and Protein Degradation” embodiment and Example 2, which are encompassed by the scope of the ’419 patent’s claim 1. *See* Ex. 1001, 4:1–60 (liquefaction), 5:18–41, 6:35–11:45 (materials and milling), 13:29–48, 17:26–18:41 (Example 2). We will not overlook these facts and do not agree with Patent Owner that WO ’179 is incorrect in disclosing the claimed subject matter. *See* Ex. 1002 ¶ 82 (discussing the similarities between the disclosures of WO ’179 and the ’419 patent); Ex. 1020 ¶¶ 104–131 (Dr. Clark explaining why WO ’179 is not scientifically incorrect); *see also* Hr’g Tr. 29:16–30:3, 31:1–6, 33:19–21 (Patent Owner explaining at oral argument that claim 1 covers the ’419 patent’s disclosed “Simultaneous Liquefaction and Protein Degradation” embodiment). Patent Owner wrongly assumes that the prior art must include more detailed instructions for carrying out the claimed task than is provided in the challenged patent itself. *See In re Morsa*, 803 F.3d 1374 (Fed. Cir. 2015) (a patent’s specification may be referenced as illuminating on the knowledge of a person of ordinary skill in the art in the context of prior art).

It is well-established that “[a] claimed invention cannot be anticipated by a prior art reference if the allegedly anticipatory disclosures cited as prior art are not enabled.” *Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354 (Fed. Cir. 2003). “[A] presumption arises that both the claimed and unclaimed disclosures in a prior art patent are enabled.” *Id.* at 1355. We find, however, that WO ’179 does not just generally disclose that a starch-containing material is liquefied using α -amylase and the resulting

liquefied mash is treated with protease, but also specifically discloses how this can be accomplished so as to fully enable the method. In this respect, WO '179 states, for example:

Apart from the *addition of exopeptidases*, the preparation of the wort, for example for brewing beer, may be *carried out as usual*. Generally, it comprises the *liquefaction of the cereal raw material to obtain a mash*, followed by saccharification of the mash to obtain a wort. Filtration prior to fermentation is important.

The *liquefaction step* usually comprises *grinding* of the cereal raw material to obtain a flour of suitable particle size, *hydrating* with from about 1 to about 4, preferably about 3 parts of water, and optionally, depending on the endoprotease used, from about 50 to about 300 ppm of calcium, preferably 200 ppm Ca^{2+} . Enzymes from *Bacillus stearothermophilus* appear to be less Calcium-dependent. Consequently, no Ca^{2+} supplementation is required in that case. The particle size of the ground cereals should not exceed about 3 mm; not more than 3,5% should exceed 1,3 mm; not more than 1,5% should be smaller than 0.25 mm. Enzymes that may be used in addition are cellulases, β -glucanases, and or other plant cell wall degrading enzymes.

The liquefaction medium is usually adjusted to a pH of between about 5 and 8, preferably between about 6 and 7, using, for example, calcium hydroxide. It is important to *add α -amylase, preferably a thermostable α -amylase* to the liquefaction medium *as well as an endoprotease* in a dosage *sufficient to at least partially liquefy* the cereal starch, and *to at least partially degrade protein*. Suitable dosages of α -amylase are from about 0,5 to about 2,0, preferably about 1 - 1,5 kg per Ton, when B.A.T.S. is used. Suitable dosages of proteases are, in the case of Brewers protease 2000, more than 0.5 kg/Ton grains (kg/T), preferably more than 1 kg/T. In the case of Panstimase 400 more than 2 kg/T, preferably more than 5, more preferably more than 10 kg/T should be used.

In the liquefaction process a number of steps are usually ***carried out at elevated temperature: after adding α -amylase and protease the mixture is maintained at a temperature between about 40°C and 65°C***, preferably between about 45 and 55°C, most preferably 50°C, ***until a sufficient liquefaction is obtained***. The time needed depends on the cereal or mixture of cereals used, but usually from ***about 30 minutes till about 2 hours*** is satisfactory. Subsequently, the temperature is raised gradually, the rate not being critical, till about 90-95°C and left at that temperature for about 30 minutes to about 1 hour. Then, the mixture is cooled to a temperature at which saccharification takes place

Ex. 1003, 4:23–5:19 (emphasis added). WO '179 further and relatedly discloses that “[i]t was found that ***the use of exo-peptidase*** during the preparation of wort, for example for brewing beer, is ***especially advantageous during the liquefaction step*** of the cereal raw material.” *Id.* at 6:3–5 (emphasis added); *see also id.* at 12:1–23:19 (Examples 1–8 where endoprotease and/or exo-peptidases are disclosed as having been used simultaneously with B.A.T.S. α -amylase during liquefaction of starch). Such disclosure teaches the claim limitations and Petitioner expressly directed the Board’s attention to these portions of WO '179 in challenging the claims of the '419 patent, and also provided testimonial support from Dr. Clark analyzing the same. *See* Pet. 13–17, 32–35, 38–41; Ex. 1002, *inter alia*, ¶¶ 33, 39–43, 80–85, 92–93, 109–131 (Dr. Clark’s testimony relating to these portions of WO '179, confirming that they disclose the claimed subject matter); Ex. 1020 ¶¶ 105–122 (Dr. Clark testifying why and how WO '179, in particular these portions, teach forming a liquefied mash, which is treated with protease).

The above-quoted portions of WO '179 begin by disclosing forming a slurry of starch-containing material (cereals) by grinding/milling the

material to obtain a flour and hydrating it with 1–4 parts water. Ex. 1003, 4:26–29; *see also* Ex. 1005, 4:20–26 (evidencing that milling of whole grain is well known in the art and opens up the grain’s structure to allow for further processing). We note that this is the process described in the ’419 patent. Ex. 1001, 4:1–25, 6:52–67 (grinding/milling whole grain, e.g., corn, wheat, or milo, and adding water to form a slurry).

The above-quoted portions of WO ’179 next teach heating the starch-containing material slurry upon adding α -amylase (a thermostable derivative from, for example, *Bacillus licheniformis*) at a dosage sufficient to liquefy the starch and also protease (endoprotease derived from, for example, *Bacillus amyloliquefaciens* or *Streptomyces fradiae*, and exo-peptidase derived from, for example, *Aspergillus niger*, *Aspergillus sojae*, and *Aspergillus oryzae*) at a dosage to at least partially degrade protein. Ex. 1003, 5:3–17, 6:3–5, 7:3–23 (disclosing exemplary enzymes); 12:1–23:19 (Examples); *see also* Ex. 1002, *inter alia*, ¶ 104 (Dr. Clark testifying that WO ’179’s commercially-available α -amylase B.A.T.S. liquefies the grain to generate very good results). Again, we note that this is the process described in the ’419 patent, particularly at its Example 2. Ex. 1001, 5:18–41, 17:25–42; *see also id.* at 4:47–59 (describing a “three-step” liquefaction process where a slurry is initially heated to, e.g., 65°C, and α -amylase is added to initiate liquefaction, where “[m]illed and liquefied whole grains are known as mash”); *see also* Pet. 24 (discussing the ’419 patent’s embodiment and citing Ex. 1001, 17:25–18:41; Ex. 1002 ¶¶ 67–69).

The above-quoted portions of WO ’179 disclose raising the temperature of this slurry up to 65°C “until a sufficient liquefaction is obtained,” which usually takes 30–120 minutes. Ex. 1003, 5:12–17. Again,

this overlaps with the heating step described in the '419 patent, which states that when liquefaction and protein degradation are carried out simultaneously, the protease treatment can be initiated at any time during liquefaction, the temperature can be raised to 25–90°C (noting 65°C as a preferred temperature, i.e., “from 65–75°C, especially around 50° or 70°C”), and the process can be carried out for 6 minutes to 12 hours. Ex. 1001, 5:18–41; *see also* Pet. 24 (discussing the '419 patent's embodiment and citing Ex. 1001, 17:25–18:41; Ex. 1002 ¶¶ 67–69).

WO '179 discloses that the cereal used for its process can be selected from sorghum, wheat, barley, oat, rice, and corn, and the like. *See* Ex. 1003, 4:6–10. Evidence of record, submitted by Patent Owner, establishes that, at the 65°C temperature used in WO '179's liquefaction process, at least some of those cereals, namely, wheat, barley, and oat, will completely gelatinize and, thus, the starch material will be susceptible to liquefaction by the α -amylase present in the liquefaction medium (corn will at least partially gelatinize). *See* Ex. 2011 ¶¶ 30, 36, 49, 85, 93, 98, 101 (Dr. Kohl testifying regarding gelatinization temperature ranges and the gelatinization temperatures for several starches); Ex. 2027, 668 (Table III, *see supra* Section II.B reproducing this table); Ex. 2030, 5571 (Table 1); Ex. 2031, 11 (Table 4); Ex. 2079, 81 (Table 1); *see also* Ex. 1035, 29:16–24 (Dr. Kohl testifying that at any given starch's midpoint gelatinization temperature approximately half of the starch sample is gelatinized), 44:21–45:8 (Dr. Kohl testifying that a present and active α -amylase will begin to act on any gelatinized starch to liquefy it); and Ex. 1020 ¶¶ 113–114 (discussing Dr. Kohl's testimony and the WO '179 disclosure). We note that the exemplary cereals of WO '179 are also disclosed by the '419 patent as

suitable for its invention. Ex. 1001, 6:35–44 (disclosing corn, cob, wheat, barley, cassava, sorghum, rye, milo, and potato as exemplary starch options).

Finally, WO '179 is explicit that its proteases are active at 65°C, when the aforementioned starches would have gelatinized and been liquefied by α -amylase. As discussed above (*see supra* Section II.B), WO '179 shows at its Figure 3 that its proteases are active at temperatures above 5°C up to below 70°C. Ex. 1003, Fig. 3. WO '179 also indicates its endoproteases, e.g., the commercially available Brewer's Protease 2000 and Panstimase 400, are active at least over the temperature range 45–55°C, which, according to Patent Owner's evidence, would be a temperature sufficient to gelatinize barley and oats to a degree. *Id.* at 7:10–16; *see also* Ex. 2027, 668; Ex. 2079, 81 (Table 1).

Thus, in view of the above, the evidence of record establishes that, under the conditions of the method of WO '179, a starch-containing slurry is formed and is liquefied by α -amylase to produce a liquefied mash, which is treated by the also-present protease. We, therefore, conclude WO '179 teaches steps (a) and (b) recited by the '419 patent's claim 1, as asserted by Petitioner. This is so whether or not gelatinization (and the associated forming a solution and liquefying a majority of a slurry) is required by the claimed process to form a liquefied mash, as asserted by Patent Owner.

Regarding Patent Owner's argument that WO '179's disclosures at "disparate sections" are not connected to one another to properly make a case for anticipation (Resp. 43), citing *Net MoneyIN*, 545 F.3d at 1370, this argument is not persuasive. *See Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1343 (Fed. Cir. 2016); *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015). WO '179 is clear that it

contemplates the combination and mixing or matching of its separately disclosed materials and processing parameters, such as exemplary enzymes, processing temperatures, pH settings, and exemplary starch types. *See generally* Ex. 1003; *see also id.* at 4:6–10 (disclosing several options for cereals in the context of its invention), 7:3–23 (disclosing a variety of optional enzymes), 12:1–23:19 (Examples mixing separately disclosed parameters and components). Therefore, we do not agree with Patent Owner’s argument.

Regarding Patent Owner’s arguments that WO ’179 does not disclose liquefying a starch-containing material because it does not teach gelatinizing the starch before treating with α -amylase, we have addressed these arguments above and they are unavailing. Resp. 37–59. Patent Owner’s arguments depend on its position that the starches of WO ’179 will not gelatinize at the initial elevated temperatures of the reference’s liquefaction step, but, as we have determined above, for several cereals disclosed in WO ’179, full gelatinization would occur at 65°C (in the presence of α -amylase). Thus, we find that Patent Owner’s arguments are unavailing.

Regarding Patent Owner’s arguments that WO ’179 does not disclose treating a liquefied mash with protease because the temperature of the reference’s process exceeds a denaturation point of proteases when a liquefied mash is produced, we also find this argument unpersuasive. *See, e.g.,* Resp. 56. The proteases disclosed by WO ’179 are not only *not denatured* at 65°C, they are expressly identified as *active* at this temperature. *See* Ex. 1003, Fig. 3. Thus, we find Patent Owner’s argument is unpersuasive.

Returning to Petitioner’s challenge against claim 1, the next step recited by claim 1 is “(c) saccharifying in the presence of a carbohydrate-source generating enzyme.” Ex. 1001, 18:49–50. We discern no dispute that this step is disclosed as a part of the alcohol production process of WO ’179. Pet. 34; *see generally* Resp. Petitioner explains where and how this step is disclosed by WO ’179. Pet. 34 (citing Ex. 1003, 5:19–25, 12:20–21, 13:21–22; Ex. 1002 ¶¶ 86–87). Moreover, Patent Owner itself recognizes that WO ’179 discloses a subsequent saccharification step, which occurs after the reference’s disclosed protease-addition to liquefied mash. Resp. 42, 52 (chart identifying the WO ’179’s process includes saccharification after what we have found to be the protease treatment step). Therefore, we conclude WO ’179 teaches this claimed step as part of its disclosed method.

The final step recited by claim 1 is “(d) fermenting in the presence of a fermenting organism to produce the alcohol.” Ex. 1001, 18:51–52. As with the preceding step, we discern no dispute that this is disclosed as part of the WO ’179 alcohol production process. Pet. 34–35; *see generally* Resp. Petitioner points out how and where WO ’179 discloses the claimed fermentation step using yeast to produce alcohol. Pet. 34–35 (citing Ex. 1003, 1:10–19, 3:7–9, 3:14–16, 5:30–6:2, 14:13–17:22; Ex. 1002 ¶¶ 88–89). Therefore, we find WO ’179 teaches this claimed step as part of its disclosed method.

We find that Petitioner has shown by a preponderance of the evidence how and why claim 1 is anticipated by WO ’179 (whether or not Patent Owner’s claim construction is adopted). We turn next to Petitioner’s anticipation challenge as it extends to dependent claims 2–7, 11, 14, 15, 17,

and 18. We discern Patent Owner presents no arguments that these dependent claims are not anticipated by WO '179, other than by virtue of Patent Owner's arguments concerning claim 1 from which they depend. *See generally* Resp. and Sur-Reply.

Claim 2 depends from claim 1 and further requires "steps (a) and (b) are carried out simultaneously or sequentially." Ex. 1001, 18:53–54. Petitioner has identified that WO '179 discloses the simultaneous addition of α -amylase and protease during liquefaction. Pet. 35–36 (citing Ex. 1003, 2:19–22, 5:3–15, 7:1–23; Ex. 1002 ¶¶ 92–93). We determine that Petitioner has shown by a preponderance of the evidence that claim 2 is anticipated by WO '179.

Claim 3 depends from claim 1 and further requires "a step of: (e) distillation to obtain the alcohol." Ex. 1001, 18:55–56. Petitioner takes the position that this additional distillation step is necessarily a part of an alcohol production process as disclosed by WO '179. Pet. 36 (citing Ex. 1002 ¶¶ 96–97). "Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates." *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002) (internal quotation marks omitted).

Petitioner asserts that, in the alcohol production industry, to which WO '179's disclosure applies, distillation to recover alcohol is an inherent part of the process, even if not expressly addressed by the reference. The portion of Dr. Clark's declaration cited by Petitioner states that distillation, as claimed, is a process of separating and concentrating alcohol from the fermented wort, which is required for producing alcoholic beverages and producing biofuel, which are the subjects of WO '179. Ex. 1002 ¶¶ 96–98

(citing Ex. 1003, 1:8–12, 5:30–6:2, 6:5–10, 6:15–18). Dr. Clark also cites the Alcohol Textbook as illustrating the alcohol production process to produce spirits or “[f]uel [a]lcohol” as requiring distillation (with a “still”). *Id.* ¶ 97 (citing Ex. 1010, x, 193, 223, 247, 275). To the extent that Petitioner and its witness argue that, without distillation, no final alcohol products would be produced (with the exception of brewed products, like beer) by the process of WO ’179, we agree.

We find that WO ’179 does focus, to some degree, on the brewing of beer, but also focuses on alcohol production in “the distilling industry.” Ex. 1003, 1:8–12. The concept of distillation is in the very name of the relevant industry addressed by WO ’179, which supports Petitioner’s assertions and its witness’s statements that a distilling step, as claimed, would necessarily occur when producing alcohol for such a purpose. Pet. 36 (citing Ex. 1002 ¶¶ 96–97). Thus, we find Petitioner has shown by a preponderance of the evidence how and why claim 3 is anticipated by WO ’179.

Claim 4 depends from claim 1 and further requires “the alcohol is ethanol.” Ex. 1001, 18:57. Petitioner does not assert that WO ’179 expressly discloses that the alcohol produced by its methods is ethanol, but, as with claim 3, asserts that it is necessarily so. Pet. 36–37 (citing Ex. 1003, 5:30–6:2, 6:15–18; Ex. 1002 ¶¶ 100–102; Ex. 1010, 1–7; Ex. 1005, 3:27–32). Petitioner’s position, as supported by its witness’s declaration, is that alcohol produced by WO ’179’s process for beverages (human consumption) and for biofuel is inherently ethanol. *Id.* We determine that Petitioner has shown by a preponderance of the evidence how and why claim 4 is anticipated by WO ’179.

Claim 5 depends from claim 1 and further requires “step (a) is carried out using a bacterial alpha-amylase or a fungal alpha-amylase.” Ex. 1001, 18:59–60. Petitioner asserts that B.A.T.S., disclosed by WO ’179, is derived from *Bacillus licheniformis* and is a bacterial α -amylase. Pet. 37 (citing Ex. 1003, *inter alia*, 7:3–8; Ex. 1002 ¶¶ 103–105; Ex. 1001, 9:1–2). We determine Petitioner has shown by a preponderance of the evidence how and why claim 5 is anticipated by WO ’179.

Claim 6 depends from claim 1 and further requires “the pH during liquefaction is from about 4.5 to 7.” Ex. 1001, 18:61–62. Petitioner asserts that WO ’179 discloses a preferred liquefaction pH of between 6 and 7, and specifically 6.5. Pet. 37 (citing Ex. 1003, *inter alia*, 5:3–4; Ex. 1002 ¶¶ 106–108). This disclosed range overlaps the claimed range and this specific disclosed point is within the claimed range. When a patent claims a range, it is anticipated by a prior art reference that discloses a point within the range, and if the prior art discloses its own range, then it anticipates if it describes the claimed range with sufficient specificity such that a reasonable fact finder could conclude that there is no reasonable difference in how the invention operates over the ranges. *Ineos*, 783 F.3d at 869. The prior art’s disclosed preferred range of 6–7 pH is within and narrower than the claimed range of 4.5–7 pH and we find it reasonable that the prior art range describes the claimed range with sufficient specificity that there is no reasonable difference between the two ranges. *See* Ex. 1002 ¶¶ 106–107. We determine Petitioner has shown by a preponderance of the evidence how and why claim 6 is anticipated by WO ’179.

Claim 7 depends from claim 1 and further requires “prior to the step (a), the steps of: i) milling of starch-containing material; [and] ii) forming a

slurry comprising the milled starch-containing material and water.”

Ex. 1001, 18:63–67. Petitioner asserts that WO ’179 discloses “conventional milling and slurry formation steps,” as claimed, in disclosing grinding and hydrating cereal raw material, which forms a slurry. Pet. 38 (citing Ex. 1001, 4:27–5:11; Ex. 1002 ¶¶ 109–113; Ex. 1010, 9). We determine Petitioner has shown by a preponderance of the evidence how and why claim 7 is anticipated by WO ’179.

Claim 11 depends from claim 1 and further requires “the protease is bacterial protease derived from *Bacillus* or *Nocardiopsis*.” Ex. 1001, 19:7–8. Petitioner asserts that WO ’179 discloses the protease Brewers Protease 2000, which is derived from *Bacillus amyloliquefaciens* (a bacterial protease), is used in its liquefaction step. Pet. 39 (citing Ex. 1003, *inter alia*, 7:10–17; Ex. 1002 ¶¶ 114–116; Ex. 1001, 7:62–64). We determine Petitioner has shown by a preponderance of the evidence how and why claim 11 is anticipated by WO ’179.

Claim 14 depends from claim 1 and further requires “the protease treatment in step (b) is carried out at a temperature of 25–90° C.” Ex. 1001, 19:13–14. Petitioner asserts that WO ’179 discloses liquefaction is most preferably carried out at “50°C, until a sufficient liquefaction is obtained.” Pet. 39 (citing Ex. 1003, 5:3–15; Ex. 1002 ¶¶ 117–119). As we noted above in discussing claim 1, this same portion of WO ’179 discloses the temperature range for this “sufficient liquefaction” is 40–65°C, even if 50°C is most preferred, which includes sufficiently high temperatures for grain gelatinization according to the evidence of record, as also discussed above. Ex. 1003, 5:12–15; Ex. 1010, 12 (Table 3). The temperature range of 40–

65°C, and the specific point of 50°C, anticipate the recited temperature range of 25–90°C. *Ineos*, 783 F.3d at 869.

As we discussed above, WO '179 discloses adding α -amylase and protease to a grain slurry and heating it to temperatures as high as 65°C for up to two hours “until a sufficient liquefaction is obtained.” Ex. 1003, 5:12–17. As discussed above, the evidence of record discloses that such temperatures are sufficient to gelatinize several of the grain types disclosed as options by WO '179 and that exposure to α -amylase liquefies the gelatinized starch to form a liquefied mash. Ex. 1010, 11–12 (α -amylase accesses starch molecules of gelatinized grain and liquefaction is accomplished by action of the α -amylase enzyme on the exposed starch molecules; corn gelatinizes at 62°C, barley at 52°C, and wheat at 58°C). We determine that Petitioner has shown by a preponderance of the evidence how and why claim 14 is anticipated by WO '179.

Claim 15 depends from claim 1 and further requires that the “protease treatment in step (b) is carried out at pH of 2–11.” Ex. 1001, 19:15–16. Petitioner asserts that WO '179 discloses a preferred pH of 6.5 during liquefaction, which is in the middle of the claimed range. Pet. 39–40 (citing Ex. 1003, *inter alia*, 5:3–4, 12:6; Ex. 1002 ¶¶ 120–122). This anticipates the recited pH range. *Ineos*, 783 F.3d at 869. We determine Petitioner has shown by a preponderance of the evidence how and why claim 15 is anticipated by WO '179.

Claim 17 depends from claim 1 and further requires “the protease treatment in step (b) is carried out for 0.1 to 12 hours.” Ex. 1001, 20:4–5. Petitioner asserts that WO '179 discloses liquefaction taking place, with the added protease, for 30–120 minutes, or, more preferably for one hour.

Pet. 40 (citing Ex. 1003, 5:15–17, 12:1–18; Ex. 1002 ¶¶ 123–126). This anticipates the recited duration. *Ineos*, 783 F.3d at 869. We determine that Petitioner has shown by a preponderance of the evidence how and why claim 17 is anticipated by WO '179.

Claim 18 depends from claim 1 and further requires “the protease is present at a concentration of 0.0001 to 1 wt.-% of TS.” Ex. 1001, 20:6–7. Petitioner asserts that WO '179 discloses using Brewers Protease 2000 at a concentration of 0.05 wt.% or 0.1 wt.% and using Panstimase 400 protease at 0.2 wt.%, 0.5 wt.%, or 1.0 wt.%, which Petitioner asserts are each within the claimed range of concentrations by wt.% of total solids. Pet. 40–41 (citing Ex. 1003, 5:8–11, 7:10–17; Ex. 1002 ¶¶ 127–129). These disclosures anticipate the recited protease concentration. *Ineos*, 783 F.3d at 869. We determine that Petitioner has shown by a preponderance of the evidence how and why claim 18 is anticipated by WO '179.

3. SUMMARY ON ANTICIPATION

Based on Petitioner’s assertions and the evidence of record, we find Petitioner has shown by a preponderance of the evidence that claims 1–7, 11, 14, 15, 17, and 18 are anticipated by WO '179.

E. OBVIOUSNESS OF CLAIMS 1–9, 11, AND 13–19 OVER WO '179, GOODE, AND WO '895

We have already discussed Ground 2 above, to some extent, in our discussion of Ground 1, which is based, in part, on the same evidence concerning WO '179. See Pet. 41–65. “It is well settled that ‘anticipation is the epitome of obviousness.’” *In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). Having found that the Petitioner has carried its burden for proving anticipation of claims 1–7, 11, 14, 15, 17, and 18 by WO '179, we

need not address the substance of these claims under our analysis of Ground 2. However, with the understanding that there are differences in the requirements for anticipation and obviousness, we also find these claims would have been obvious over the cited prior art because all of the limitations are met for the same reasons the claims are anticipated by WO '179, as discussed above. Moreover, there is motivation to combine the cited prior art and a reasonable expectation of success, and, for the reasons set forth in section II.E.2 below, Patent Owner's objective indicia evidence does not weigh in favor of patentability. *See* Pet. 41–48, 63–65; Reply, 23–25, 26–27; *see also infra* Sections E.1 and E.2.

We address the combination of prior art as it applies to claims 8, 9, 13, 16, and 19 below.

I. MOTIVATION TO COMBINE AND REASONABLE EXPECTATION OF SUCCESS

As noted above, under Ground 2 Petitioner combines the teachings of WO '179, Goode, and WO '895. Petitioner asserts that a person of ordinary skill in the art in 2005 would have been motivated to combine these references because they are each directed to an ethanol production process and because WO '179 and Goode express there are advantages (*inter alia*, increasing FAN, increasing wort yield, increasing wort filterability, expanding the range of types of cereal grains for ethanol production, improving organoleptic properties of the wort, increasing high-molecular weight nitrogen) that can be directly achieved by using proteases during the otherwise conventional ethanol production process (like that taught by WO '895), specifically during the liquefaction step. Pet. 41–47 (citing Ex. 1001, 1:43–59; Ex. 1002 ¶¶ 77–91, 133, 136–144; Ex. 1003, 1:8–9, 1:15–19, 2:13–16, 2:19–22, 2:31–3:2, 3:14–16, 4:2–17, 5:3–15, 6:13–27,

12:1–21:22 (Examples); Ex. 1004, 69–71 (Table I, Figs. 1, 2), 73, 76, 77; Ex. 1005, 3:26–4:17, 4:28–5:8, 5:10–6:3, 27:10–21 (claim 15)). Petitioner asserts that the motivation to combine the references specifically extends to using the disclosed proteases before saccharification. *Id.* at 44 (citing Ex. 1002 ¶ 136). Petitioner also asserts that the compatibility of these references “would have been readily apparent to skilled artisans” because they basically describe the same process, with the same steps, and each achieve favorable properties in producing alcohol, and Petitioner asserts a skilled artisan would have had a reasonable expectation of success in making the prior art combination to produce alcohol. *Id.* at 42, 45, 47 (citing Ex. 1002 ¶¶ 32, 77–91, 141, 144).

Considering the evidence of record, we find that Petitioner has shown that the cited prior art (WO ’179, Goode, and WO ’895) would have been combined by a person of ordinary skill in the art, who would have reasonably expected success in doing so to achieve the claimed subject matter. Each of WO ’179, Goode, and WO ’895 “is from the same field of endeavor,” i.e., ethanol production, and each is also “reasonably pertinent to the particular problem with which the inventor is involved,” i.e., improving ethanol production by adding protease during the process. *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1000–01 (Fed. Cir. 2016). Thus, each of these references is suitable for use in an obviousness combination. *Id.*

As Petitioner asserts, most of the process defined by the ’419 patent’s claim 1 is a conventional ethanol production process (i.e., liquefaction of a grain slurry with α -amylase, saccharification with an enzyme, fermentation using yeast) and each cited reference is directed to such steps. *See generally* Ex. 1003; Ex. 1004; Ex. 1005; *see also* Ex. 1002 ¶¶ 34–58 (discussing these

references). Furthermore, each reference discloses that using proteases during such processes is advantageous for various reasons (noted above). *See, e.g.*, Ex. 1003, 2:31–3:2; Ex. 1004, 73, 77; Ex. 1005, 14:15–18. Thus, we agree with Petitioner’s assertions and we determine the ordinary skilled artisan would have been motivated to combine these references for the advantages disclosed by the references. Based on the information presented, no hindsight is evident in Petitioner’s arguments and hindsight would not have been necessary to make the prior art combination to achieve the claimed invention.

Moreover, as already noted, most of the process steps disclosed by each of WO ’179, Goode, and WO ’895 are conventional. *See* Ex. 1003, 1:15–2:5 (describing liquefaction, saccharification, and yeast fermentation, including use of enzymes, including proteases, as background manufacturing steps); Ex. 1004, 69 (describing mashing/liquefaction, saccharification, and fermentation as ancient techniques and including the use of enzymes like α -amylases and proteases); Ex. 1005, 4:1–7 (identifying the standard steps of ethanol production: milling, liquefaction, saccharification, fermentation, and distilling). WO ’179 indicates that adding protease during the liquefaction step succeeds; Goode indicates that adding protease during the liquefaction/mashing step succeeds; and WO ’895 indicates that adding protease during pre-saccharification or during fermentation succeeds; and each reference indicates that its other, conventional steps succeed in producing an alcohol product. Ex. 1003, 2:19–3:16 (adding protease during liquefaction to grains or to liquefied mash has advantages in producing alcohol); Ex. 1004, 69 (adding protease at mash-in is part of optimization of process); Ex. 1005, 2:6–15 (results in increased fermentation rate and

ethanol yield). Thus, Petitioner shows by a preponderance of the evidence that success would have been reasonably expected to achieve the claimed invention with such a prior art combination.

In view of the strong evidence to the contrary, understanding that Petitioner always has the burden of proof here, no argument by Patent Owner that “The Petition Identifies No Rationale for Modifying WO179, Goode and WO895 that Yields the Claimed Process” is persuasive. *See* Resp. 59–74.

We do not agree with Patent Owner’s argument that the references would not have been combined because WO ’895 already teaches using a protease during ethanol production, but at a later stage than WO ’179. *See, e.g., id.* at 60–62. Patent Owner’s focus on what WO ’895 teaches individually is not persuasive, as non-obviousness cannot be established by attacking references individually where obviousness is based upon the teachings of a combination of references, as it is here. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *see also Enzo Life Scis., Inc. v. Becton, Dickinson and Co.*, 780 F. App’x. 903, 910 (Fed. Cir. 2019) (confirming this principle applies not only to patent prosecution, but to *inter partes* disputes). It is apparent from the combined references that the skilled artisan would have understood there was good reason to add protease at various or multiple stages of ethanol production, including to a liquefied mash before saccharification. *See generally* Ex. 1003; Ex. 1004; Ex. 1005.

For the reasons discussed above at Section II.D.2, we are also not persuaded by Patent Owner’s arguments that WO ’179’s proteases would be inactivated before treating a liquefied mash. *See, e.g.,* Resp. 62–67. Again, Patent Owner’s arguments err in looking only at the prior art references

individually (e.g., Goode’s protease was inactivated at a certain temperature); they fail to take into consideration that WO ’179 teaches gelatinizing a starch slurry, liquefying it with α -amylase, and treating it with protease, as well as that its proteases are specifically active at the starch’s gelatinization temperatures and liquefaction by α -amylase. *See supra* Section II.D.2.

We are also not persuaded by Patent Owner’s arguments that the Petition fails to explain how the processes of the prior art would have been modified in view of one another. Resp. 71–74. Petitioner is clear that the focus of the ’419 patent’s invention, i.e., treating a liquefied mash with a protease before saccharification, is taught by WO ’179, and that the disclosure of WO ’895 is cited for more conventional aspects of the claimed process, for which WO ’179 may be less explicit, and Goode supplies added motivation to use the WO ’179 protease treatment pre-saccharification. Pet. 41–48. We find Petitioner’s rationale reasonable, logical, and persuasive. For example, Petitioner includes, *inter alia*, a list of seven specific reasons why a skilled artisan would have sought to add a protease during the liquefaction stage of ethanol production, each of which supplies a reason to combine the cited prior art to achieve the claimed invention. Pet. 45–47.

We address Petitioner’s positions on the dependent claims and issues specific to the patentability of those claims below.

2. *UNEXPECTED RESULTS*

Patent Owner asserts that “[s]econdary considerations directly linked to the claimed method reinforce its non-obviousness” and that “the evidence demonstrates the claimed method achieves unexpected results.” Resp. 78. Our reviewing court has held that:

Consistent with the rule that all evidence of nonobviousness must be considered when assessing patentability, the PTO must consider comparative data in the specification in determining whether the claimed invention provides unexpected results. *In re Margolis*, 785 F.2d 1029, 1031 (Fed. Cir. 1986). However, “it is well settled that unexpected results must be established by factual evidence. Mere argument or conclusory statements in the specification does not suffice.” *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984); *see also In re Wood*, 582 F.2d 638, 642 (CCPA 1978) (“Mere lawyer’s arguments and conclusory statements in the specification, unsupported by objective evidence, are insufficient to establish unexpected results.”); *In re Lindner*, 457 F.2d 506, 508 (CCPA 1972) (“Mere conclusory statements in the specification . . . are entitled to little weight when the Patent Office questions the efficacy of those statements.”).

In re Soni, 54 F.3d 746, 750 (Fed. Cir. 1995) (citations to USPQ reporter omitted, alteration in original). Under *Graham*, we consider evidence of such objective indicia of non-obviousness in analyzing the obviousness issue as a whole. *Graham*, 383 U.S. at 17–18. However, “[t]o be particularly probative, evidence of unexpected results must establish that there is a difference between the results obtained and those of the closest prior art, and that the difference would not have been expected by one of ordinary skill in the art at the time of the invention.” *Bristol-Myers Squibb Co. v. Teva Pharms. USA, Inc.*, 752 F.3d 967, 977 (Fed. Cir. 2014).

Patent Owner argues that, according to Dr. Kohl, the claimed invention provides unexpected lower glycerol levels, reduced lactic acid production, related reduced exogenous nitrogen requirements, as well as higher fermentation, and better yields (as illustrated by the examples in the ’419 patent and the commercial activities of Patent Owner). Resp. 79 (citing Ex. 2001 ¶ 82). Relatedly, Patent Owner argues that Malliard reactions are

avoided. *Id.* at 81 (citing Ex. 2011 ¶¶ 295–297). Notably absent from Patent Owner’s arguments and Dr. Kohl’s testimony is any comparison to any results of the method disclosed by WO ’179, which is the closest prior art. *See* Resp. 78–83; Ex. 2001 ¶¶ 79–88; Ex. 2011 ¶¶ 293–300.

Petitioner argues “the ’419 patent specification provides no comparison to any prior art, much less the closest prior art” and “Dr. Clark analyzed the examples of the ’419 patent in view of the closest prior art, which in his view is WO ’179.” Pet. 63 (citing Ex. 1001, 16:35–18:41 (Examples 1 and 2); Ex. 1002 ¶¶ 210–219). Petitioner argues that the ’419 patent’s Examples 1 and 2 report improved FAN levels, and directly related improved ethanol yields, glycerol levels, and glucose levels, when adding protease either during or after liquefaction, but that the same FAN improvement was reported by WO ’179 and Goode. *Id.* at 64–65 (citing Ex. 1001, 3:8–21, 17:15–24, 18:21–41; Ex. 1003, 4:2–5, 6:13–21; Ex. 1004, 69–70, 73; Ex. 1002 ¶¶ 211–214, 217). Petitioner, citing Dr. Clark’s declaration, asserts that it was known in the prior art (as early as 1990) that higher FAN in ethanol production can accelerate fermentation, increase ethanol yields, improve the conversion of glucose (sugar) to ethanol, and lower residual glucose levels. *Id.* at 64 (citing Ex. 1002 ¶ 213; Ex. 1006, 2046, 2048); *see also* Reply 26. Thus, argues Petitioner, as explained by Dr. Clark, as of 2005 the ’419 patent’s invention’s results would have been expected in view of the closest prior art, i.e., WO ’179. Pet. 65 (citing Ex. 1002 ¶¶ 210–218).

Having considered each party’s assertions and evidence, we are not convinced that the evidence of record shows unexpected results establishing non-obviousness. Petitioner asserts that Patent Owner cannot show

unexpected results over the closest prior art, i.e., WO '179. Pet. 63. As noted, Patent Owner does not make a comparison between the results achieved by its claimed invention and any results achieved using the processes disclosed in WO '179. Patent Owner advances no comparison between its alleged unexpected results and any results achieved by the WO '179 process even after we expressly noted this shortcoming in Patent Owner's evidence in our Institution Decision. DI 51. Thus, for these reasons, we find Patent Owner's arguments on this point are not persuasive. *Bristol-Myers*, 752 F.3d at 977.

Also, Petitioner has maintained from the outset that WO '179 and Goode each disclose that treating a grain mash with protease before saccharification increases FAN levels in the fermentation product. *See* Pet. 63–65. Furthermore, Petitioner directs us to evidence that such FAN level increases are directly related to the results Patent Owner asserts were unexpected, i.e., higher ethanol yields, lower glycerol levels, and, although indirectly asserted, lower lactic acid levels as a result of better conversion of sugar to ethanol; each of which the '419 patent at column 3 shows is directly related to increased FAN levels. *Id.* Thus, we are not convinced that the results proffered by Patent Owner in the Specification of the '419 patent or in its Exhibit 2005 are unexpected in view of WO '179 (or Goode).

3. *DEPENDENT CLAIMS 8, 9, 13, 16, AND 19*

The Petition addresses each of claims 1–9, 11, and 13–19 under Ground 2 and identifies similar evidence in WO '179 (Ex. 1003) as supported by the Clark Declaration (Ex. 1002) as presented in Ground 1. As noted above, all but claims 8, 9, 13, 16, and 19 have been discussed as anticipated by WO '179 under Ground 1. As noted, we recognize there are

differences in the evidentiary requirements for anticipation and obviousness, but we find claims 1–7, 11, 14, 15, 17, and 18 would have also been obvious over the teachings of WO '179 for the same reasons the reference anticipates these claims, as WO '179 teaches or suggests all the limitations of these claims. The disclosures of Goode and WO '895 only reinforce this determination. Therefore, we analyze below Petitioner's challenges to and Patent Owner's arguments relating to the as-yet-unaddressed dependent claims.

Claim 8 depends from claim 7 and further requires “the slurry is heated to above the initial gelatinization temperature.” Ex. 1001, 19:1–2. Petitioner asserts that each of WO '179, Goode, and WO '895 teach heating a slurry above an initial gelatinization temperature (for the grain), i.e., 50–75°C. Pet. 53–54 (citing Ex. 1002 ¶¶ 170–173; Ex. 1001, 4:31–36; Ex. 1003, 5:12–18; Ex. 1004, 69, 71–72, 77; Ex. 1005, 5:4–5, 28:3–4). As we noted above regarding Ground 1, WO '179 discloses using a variety of grains, including corn, oat, barley, and wheat, and heating a slurry of such grains to 65°C, and the Alcohol Textbook and other evidence of record discloses that the initial gelatinization temperatures for these grains are below 65°C. *See supra* Section II.D.2 (discussing Ex. 1003 and Ex. 1010).

Patent Owner argues

The petition also did not present a scientifically coherent rationale how the combination of WO179, Goode and WO895 could render claims 8 and 9 obvious to a skilled person. Those claims require heating the slurry to above the initial gelatinization temperature or jet cooking it *before* performing α -amylase treatment (step (a)). But a protease added to the WO895 slurry, as WO179 and Goode both teach, will be rendered inactive *before* WO895's process adds the α -amylase—*after* heating to “between 60-95C° [*sic*], preferably

80-85°C,” or “jet-cooking” at 95-140°C.^[1] The liquefied mash cannot form without α -amylase.

Resp. 62–63 (footnote omitted, emphasis Patent Owner’s); *see also id.* at 75.

Contrary to Patent Owner’s argument, claim 8 (as with claim 7 from which it depends) does not recite precisely when the slurry is heated to above the initial gelatinization temperature. *See* Ex. 1001, 18:63–19:2. However, as discussed above, even if we accept that Patent Owner is correct that claim 8’s recited heating of the slurry to above the initial gelatinization temperature requires the heating to happen before liquefying with α -amylase, WO ’179 discloses this. *See supra* Section II.D.2 (discussion of WO ’179, 4:23–5:19, 6:3–5, 12:1–23:19).

As noted above, Patent Owner’s focus on what WO ’895 teaches individually is not persuasive, as non-obviousness cannot be established by attacking references individually where obviousness is based upon the teachings of a combination of references, as it is here. *In re Merck*, 800 F.2d at 1097. As discussed above, WO ’179 teaches forming a slurry of, e.g., barley flour, and heating that slurry to, e.g., 65°C in the presence of α -amylase and protease so that the slurry is liquefied by the α -amylase and the resultant liquefied mash is treated by the protease. Any subsequent heating of this material might serve to further prepare the material for saccharification and fermentation, but the claim requirements will have already been met by WO ’179’s process. Thus, we find that Petitioner has shown by a preponderance of the evidence that claim 8 would have been obvious over WO ’179, Goode, and WO ’895.

Claim 9, like claim 8 depends from claim 7, and further requires “the slurry is jet-cooked at a temperature of 95-140° C. before step (a).” Ex. 1001, 19:3–4. Petitioner asserts that WO ’895 discloses this as

conventional during a three-step hot slurry process. Pet. 54–55 (citing Ex. 1002 ¶¶ 174–177; Ex. 1005, 5:1–8; Ex. 1001, 4:44–59 (calling the step conventional)). Petitioner asserts that its witness, Dr. Clark, testifies that a pre-liquefaction gelatinization step including jet-cooking at 95–140°C was known. *Id.* at 55 (citing Ex. 1002 ¶ 176; Ex. 1019, 4:7–20; Ex. 1004, 69; Ex. 1005, 4:28–35; Ex. 1010, 17–18). Petitioner argues that it would have been obvious to add jet-cooking and enzyme addition steps, as taught in WO '895, to an alcohol production process as taught by WO '179 or Goode, to achieve complete liquefaction—Dr. Clark calls such “pre-liquefaction ‘gelatinization’ steps.” *Id.* (citing Ex. 1002 ¶ 176).

As noted above, Patent Owner makes the same argument for claim 9 as for claim 8, and it remains unavailing. The evidence supports that it would have been obvious to heat a slurry before α -amylase liquefaction to fully gelatinize the starch. *See* Ex. 1001, 4:44–59; Ex. 1004, 69; Ex. 1005, 5:1–8; Ex. 1010, 11–12 (*see* Fig. 2), 17–18; Ex. 1019, 4:7–20; Ex. 1002 ¶¶ 176; *see also generally* Resp. (arguing such gelatinization was well-known to be required before α -amylase treatment). Therefore, we find that Petitioner has shown how the subject matter of claim 9 would have been obvious over WO '179, Goode, and WO '895, which, as discussed above, would have been combined by the ordinary skilled artisan.

Claim 13 depends from claim 1 and further requires “step (b) is carried out at conditions optimal for the protease in question.” Ex. 1001, 19:11–12. Petitioner asserts that Goode discloses this claim limitation as it teaches seeking pH and temperature optima, and variables thereof used for beneficial results, for various proteases. Pet. 56–57 (citing Ex. 1002 ¶¶ 181–

186; Ex. 1004, 69–72, 74–76). Patent Owner makes no additional, specific arguments for claim 13.

Based on the evidence of record, we find that the ordinary skilled artisan would have had knowledge of a variety of useful proteases as well as of the optimal conditions (e.g., pH and temperature) for protease treatment, and would have had good reason to perform a protease treatment (as in WO '179 or Goode or WO '895) under such optimal conditions (e.g., for the most protease activity, resulting in, e.g., good filtration). *See, e.g.*, Ex. 1004, 69–72, 75; *see also* Ex. 1005, 79:10–11:29 (disclosing known proteases and how to measure their activity), Figs. 1–3 (illustrating protease activity vs. temperature and pH); *see also* Ex. 1005, 14:23–15:21 (disclosing several known and commercially available proteases). We have found that the cited prior art would have been combined by the ordinary skilled artisan with an expectation of success, and we also find that Petitioner has shown that claim 13 would have been obvious over WO '179, Goode, and WO '895.

Claim 16 depends from claim 1 and further requires “the liquefied starch in step (b) has a concentration of 20–50% (w/w) Total Solids (TS).” Ex. 1001, 20:1–3. Petitioner asserts that this claim limitation is taught or suggested by each of WO '895, WO '179, and Goode. Pet. 59–60 (citing Ex. 1002 ¶¶ 194–198; Ex. 1005, 17:17–22, 24:5–6; Ex. 1004, 72; Ex. 1003, 4:27–30, 12:4–5, 13:15–21:22). Petitioner asserts that WO '895 teaches liquefied starch having a concentration of 28%, 30%, or 33% dry matter, i.e., total solids, that Goode teaches a milled mash-in liquor creating a mash having 20% w/w solids, and that WO '179 teaches mash having 20%, 25%, or 50% overall solids. *Id.* Patent Owner makes no specific arguments for claim 16. Because the cited disclosures of WO '179, WO '895, and Goode

teach the claimed concentrations of solids, we determine that Petitioner has shown claim 16 would have been obvious over WO '179, Goode, and WO '895.

Claim 19 depends from claim 1 and further requires “the saccharification in step (c) is carried out as a pre-saccharification step lasting for about 40 to 90 minutes, at a temperature of about 28–65° C. and a pH of 4–6, followed by complete saccharification during fermentation in a simultaneous saccharification and fermentation process (SSF).” Ex. 1001, 20:9–14. Petitioner asserts that WO '895 teaches these claim elements, for example, in stating “it is common [to] only . . . do a pre-saccharification of typically 40–90 minutes at 30–65°C, typically at about 60°C and then [a] complete saccharification during fermentation (SSF),” and performing pre-saccharification and SSF at 4 and 5, or 4.5 pH. Pet. 62 (citing Ex. 1002 ¶¶ 207–209; Ex. 1005, 5:17–21). Patent Owner makes no specific arguments for claim 19. Because WO '895 discloses the claimed step and parameters, Petitioner has shown claim 19 would have been obvious over WO '179, Goode, and WO '895.

4. *SUMMARY ON OBVIOUSNESS*

We determine, regardless of whether Patent Owner's claim construction position is adopted, Petitioner has shown by a preponderance of the evidence that claims 1–9, 11, and 13–19 would have been obvious over WO '179, Goode, and WO '895.

III. CONCLUSION

On the record in this proceeding, Petitioner has shown by a preponderance of the evidence that claims 1–9, 11, and 13–19 of the '419

patent would have been anticipated by WO '179 or obvious over WO '179, Goode, and WO '895.²³ In summary:

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims <u>Not</u> Shown Unpatenable
1–7, 11, 14, 15, 17, 18	102	WO '179	1–7, 11, 14, 15, 17, 18	
1–9, 11, 13–19	103	WO '179, Goode, WO '895	1–9, 11, 13–19	
Overall Outcome			1–9, 11, 13–19	

ORDER

Accordingly, it is hereby:

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1–9, 11, and 13–19 of the '419 patent are *unpatentable*; and

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

²³ 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).

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