

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTERNATIONAL FLAVORS & FRAGRANCES INC.,
Petitioner,

v.

ZOOMESSENCE, INC.,
Patent Owner.

Case IPR2015-01418
Patent 8,939,388 B1

Before MITCHELL G. WEATHERLY, JAMES A. TARTAL, and
JAMES A. WORTH, *Administrative Patent Judges*.

Opinion for the Board filed by *Administrative Patent Judge* WEATHERLY.
Opinion Dissenting filed by *Administrative Patent Judge* WORTH.

WEATHERLY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318; 37 C.F.R. § 42.73

I. INTRODUCTION

On June 6, 2015, Petitioner International Flavors & Fragrances Inc. (“IFF”) filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1, 16, 19, and 28–30 of U.S. Patent No. 8,939,388 B1 (the ’388

patent, Ex. 1001). On September 16, 2015, Patent Owner ZoomEssence, Inc. (“ZoomEssence”) filed a Preliminary Response (Paper 5, “Prelim. Resp.”). In the interim, on September 15, 2015, a Certificate of Correction (Paper 7) issued, with a correction to claim 28.¹ On November 3, 2015, Petitioner submitted, with authorization from the Board, a Reply Regarding *Inter Partes* Review of the Corrected Version of Dependent Claim 28 of U.S. Patent No. 8,939,388 (Paper 9, “Reply”). On November 17, 2015, Patent Owner submitted a Sur-Reply to Petitioner’s Reply Regarding *Inter Partes* Review of Claim 28 of U.S. Patent No. 8,939,388 (Paper 10, “Sur-Reply”).

Pursuant to 35 U.S.C. § 314, we instituted trial as to claims 1, 16, 19, and 28–30 of the ’388 patent, as corrected. Paper 11 (“Dec. Inst.”). Patent Owner filed a request for rehearing of the Decision on Institution (Paper 13), which was denied. Paper 17.

After institution of trial, Patent Owner filed a Patent Owner Response to the Petition (Paper 18, “PO Resp.”). Petitioner filed a Reply to Patent Owner’s Response (Paper 20, “Pet. Reply”).

An oral hearing was held on August 9, 2016, a transcript of which has been entered in the record. Paper 23 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6(b). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1, 16, 19, and 28–30 of the ’388 patent are unpatentable.

¹ The procedural history is discussed in more detail in an interlocutory Order on the Conduct of the Proceedings (Paper 8) (PTAB Oct. 21, 2015).

A. Related Matters

The parties identify the following district court proceeding as a related matter: *ZoomEssence, Inc. v. International Flavors & Fragrances Inc.*, Case No. 3:20-cv-01471 (D.N.J.) (misappropriation of trade secret and breach of contract). Pet. 3; Paper 4, 2. Patent Owner also identifies the prosecution of a related application before the Office, i.e., U.S. Patent Application No. 14/606,771 (filed January 27, 2015), which is a continuation-in-part of the application that led to the issuance of the '388 patent. See Paper 4, 2.

B. The '388 Patent²

The '388 patent is titled “Methods and Apparatus for Low Heat Spray Drying,” and relates to “spray drying a liquid product into a dried powder without applying heat, or applying substantially low amounts of heat.” Ex. 1001, at [54], 1:14–16. The '388 patent explains that spray drying technology has existed since the late 1800's and has continually evolved over the past century. *Id.* at 1:19–20. The method is generally typified by (1) the formation of a homogenized suspension, or slurry, consisting of (a) a solvent (e.g., water), (b) a carrier (e.g., a modified starch), and (c) a desired substituent (e.g., a food, fragrance, or medicament); (2) dispersing the slurry into a controlled spray of droplets using an atomizer; and (3) feeding the sprayed droplets from the atomizer into a drying chamber with heated air. *Id.* at 1:23–29. The '388 patent describes a problem that existed in prior art methods which exposed atomized droplets of the slurry to high temperature air in the drying chamber, “typically on the order of 200°C” leaving the heater, and “usually in excess of 100°C” exiting the drying chamber, in

² As set forth above, the '388 patent was the subject of a Certificate of Correction that issued on Sept. 15, 2015. Paper 7.

which evaporation and head degradation lowered the performance characteristics of the final dried powder. *Id.* at 2:9–27; *see also id.* at 1:36–40 (temperature entering drying chamber traditionally in the range of 180–200°C).

The '388 patent discloses applying an electrostatic charge on at least some wet particles and continuing the suspending step, without the presence of any heated drying fluids, for a sufficient time to drive off a sufficient amount of the liquid solvent within most of the wet particles to leave a plurality of dried particles (the powder). *Id.* at 2:53–61, 3:4–15. The repulsive forces induced by electrostatic charge allow the wet particles to stay suspended and to divide into sub-particles. *Id.*

Certain embodiments for temperature are disclosed as follows:

Preferably, a temperature of the non-heated drying fluid is less than about 100°C. at introduction into the drying chamber, such as at least one of: less than about 75°C. at introduction into the drying chamber; less than about 45°C. at introduction into the drying chamber; less than about 35°C. at introduction into the drying chamber; less than about 30°C. at introduction into the drying chamber; and at about an ambient temperature of a room within which the drying chamber is located.

Id. at 2:62–3:3.

The '388 patent further discloses ranges of viscosity, e.g., greater than about 300 mPa-s; between about 500–16,000 mPa-s; and between about 1000–4000 mPa-s. The '388 patent also discloses that the ratio of water within the slurry at the atomization step is about 30 percent by weight, or between 20–50% by weight. *Id.* at 3:16–29. Alternatively or additionally, the methods and apparatus may further provide for dehumidifying the drying fluid before introducing it into the drying chamber. *Id.* at 3:7–10.

The system of the '388 patent is depicted below in Figure 2:

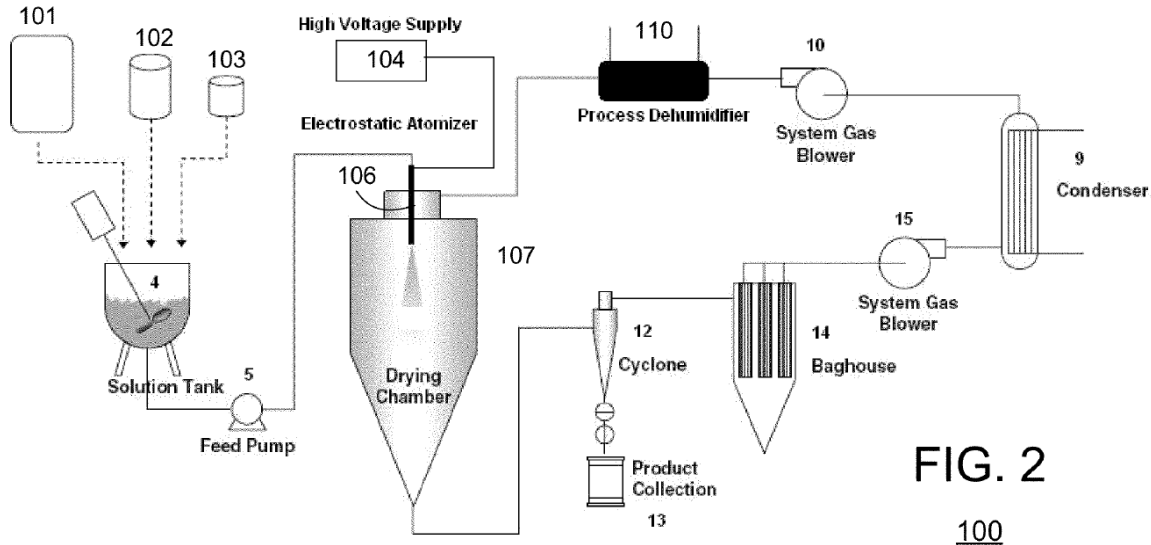


Figure 2 depicts the system in which feed pump 5 sends a slurry (or solution) into electrostatic atomizer 106, which sprays droplets into a drying chamber 107 “without employing heated air.” *Id.* at 4:45–47, 5:12–26.

C. Illustrative Claims

The Petitioner challenges claims 1, 16, 19, and 28–30 of the '388 patent. Of these, claim 1 is an independent claim directed to a system. Claims 16, 19, and 28 each recite a system and each depend directly or indirectly from claim 1. Claim 29, is directed to a method, and claim 30 is directed to an article, a “dried powder . . . , formed by the method of claim 29.”

Independent claim 1 is reproduced below:

1. A system for spray drying a liquid product into a dried powder, comprising:

 a drying chamber, including an inlet end, an outlet end, and an internal volume within which the liquid product is dried in contact with a drying fluid therein;

 an atomizer adapted to receive the liquid product in a form including a liquid solvent, a carrier, and an active ingredient, and

to discharge atomized liquid product into the drying chamber for contact with the drying fluid to form the dried powder containing the active ingredient encapsulated within the carrier;

further comprising a source of said liquid solvent, a source of carrier, and a source of active ingredient(s), a tank equipped with a stirring device and arranged to receive liquid solvent, carrier, and active ingredient(s) from said sources to form the liquid product comprising a slurry having viscosity in a range of from 500 to 16,000 mPa-s, wherein the liquid solvent comprises water, wherein the carrier comprises starch, and wherein the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C.

Ex. 1001, 12:55–13:8.

Corrected claim 28 is reproduced below:

28. The system of claim 1, further comprising a dehumidifier arranged to dehumidify the drying fluid prior to its flow through the drying chamber.

Paper 7.

D. Grounds of Unpatentability Instituted for Trial

We instituted a trial based on the following grounds of unpatentability:

References	Basis	Claims challenged
Merritt ³	§ 102	1, 16, 19
DeRoos ⁴ , Dobry ⁵ , Skelbæk ⁶ , and Tanaka ⁷	§ 103	1, 16, 19

³ Merritt, U.S. Patent No. 4,276,312, iss. June 30, 1981 (Ex. 1005).

⁴ DeRoos, U.S. Patent No. 6,482,433 B1, iss. Nov. 19, 2002 (Ex. 1006).

⁵ D. Dobry et al., *A Model-Based Methodology for Spray-Drying Process Development*, J. PHARM. INNOV., available at Springerlink.com (online publication, July 25, 2009) (“Dobry,” Ex. 1007).

⁶ Skelbæk, WO 91/17821, pub. Nov. 28, 1991 (Ex. 1008).

⁷ Tanaka, U.S. Patent No. 5,227,017, iss. July 13, 1993 (Ex. 1009).

References	Basis	Claims challenged
Merritt, Dobry, and Skelbæk	§ 103	1, 16, 19
Merritt, Dobry, and Watanabe ⁸	§ 103	28
Merritt, Dobry, Skelbæk, and Watanabe	§ 103	29 and 30

II. ANALYSIS

A. Claim Interpretation

In an *inter partes* review, the Board interprets claim terms in an unexpired patent according to the broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R.

§ 42.100(b); *see also* *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (affirming that USPTO has statutory authority to interpret claims according to Rule 42.100(b)). Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

Petitioner proposes interpretations of “spray drying,” “liquid product,” “carrier,” “mPa-s,” “the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C,” “[a] dried powder containing an active ingredient encapsulated within a carrier, formed by the method of claim 29,” and “active ingredient.” Pet. 6–8.

⁸ Watanabe, U.S. Patent Application Pub. No. 2005/0031769 A1, pub. Feb. 10, 2005 (Ex. 1011).

Patent Owner proposes an alternative interpretation for “the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C” as requiring that all the drying fluid at any location in the drying chamber must be within the recited temperature range. PO Resp. 22–33.

We interpret claim terms relevant to issues in dispute and to the extent necessary to resolve the issues presented by the parties. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999). Terms requiring express interpretation to resolve issues in dispute include the following phrases: “drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C” (the “temperature limitation” of claim 1), “system for spray drying a liquid product into a dried powder” (the preamble of claim 1) and “dried powder containing the active ingredient encapsulated within the carrier” (as used in the body of claims 1, 29, and 30).⁹ We address each phrase below.

1. Temperature Limitation

As with the Decision on Institution, we expressly interpret “drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C.” In the Decision on Institution, we noted that the term “comprising” is an open transition which generally precedes a non-exhaustive recitation of elements, and accordingly declined Patent Owner’s invitation to require all air to be below 100°C. Dec. 11. Rather, we reasoned for purposes of Institution that the “comprising” language indicates that as long as air at the outlet is below 100°C, then the

⁹ Claim 30 recites “an active ingredient” rather than “the active ingredient,” which we do not consider to be a meaningful difference.

“comprising” limitation would be met. Dec. 11. We further reasoned that the portion of the Specification on which the Patent Owner was relying described a preferred embodiment, and that our preliminary interpretation was consistent with other portions of the Specification. *Id.* (citing Ex. 1001, 2:9–27).

Patent Owner renews its argument that the limitation on the temperature of the “drying fluid” requires that all air within the drying chamber be between the freezing temperature of the solvent and 100°C. Patent Owner argues that failure to adopt its proposed interpretation would result in an interpretation that is inconsistent with the Specification. PO Resp. 22–33. In particular, Patent Owner points to numerous statements in the Specification including: “without applying heat,” “without employing heated air,” “non-heated air,” “a temperature of non-heated drying fluid (air) introduced into the drying chamber 107 may be at least one of: less than about 100°C.; less than about 75°C.; less than about 45°C.; less than about 35°C.; less than about 30°C.,” “without applying heat;” “non-heated drying fluid;” “a feed of non-heated fluid (such as air or another suitable gas) is supplied into the drying chamber;” “non-heated air may be used;” “without the presence of any heated drying fluids;” “non-heated air;” “no heat spray drying process;” “no-heat drying process;” “no-heat process;” “no-heat powder;” “no-heat samples;” “at about an ambient temperature of a room within which the drying chamber is located;” “40°C;” and “less than 50°C.” PO Resp. 27–29 (referring to Ex. 1001, 4:42–47, 5:45–47, 7:25–37, 1:15–16, 2:47–48, 2:62, 5:24–26; 5:56, 6:25, 9:38, 9:64, 9:67, 10:3, 10:26, 11:15, 11:24, 11:65, 12:3, 12:8, 12:10, 12:17, 2:63–67, 3:1–3, 7:36, 10:30).

Here, Patent Owner’s proposed interpretation would limit all air within the drying chamber to be below 100°C, for purposes of claim 1. However, our review of unchallenged claims depending from claim 1 and the Specification weighs in favor of finding that claim 1 may encompass a system in which some air within the drying chamber is above 100°C so long as at least some air is below 100°C. For example, claim 2, which depends from claim 1, excludes “the presence of any heated drying fluids at a temperature in a range of 180–200°C.”¹⁰ Ex. 1001, 13:27–28. Claim 4 depends from claim 3, which depends from claim 2, further recites that “a temperature of the drying fluid is less than about 100°C. at introduction into the drying chamber.” *Id.* at 13:36–38. Claim 5, which depends from claim 4, further recites progressively lower limits on the highest permitted temperature of “the drying fluid . . . at introduction into the drying chamber” of 75°C, 45°C, 35°C, and 30°C. *Id.* at 13:39–44. Accordingly, claims 4 and 5 refer to upper limits on the temperature of the drying fluid at a specific location, namely, “at introduction into the drying chamber.”

¹⁰ At the hearing, Patent Owner argued that the reference in claim 2 to “heated drying fluids” of up to 180°C refers to “extraneous drying fluids” other than air but that the air within the drying chamber is limited to the temperature range of freezing to 100°C. Tr. 36:5–37:2. Because Patent Owner did not advance such an argument in its papers during the trial, the argument is not properly before us. See 37 C.F.R. § 42.70(a) (limiting requests for oral argument to “an issue raised in a paper”). Even if it were before us, the argument is unpersuasive. Indeed, if, as allowed by claim 2, another drying fluid just below 180°C were present in the drying chamber with the air, Patent Owner admits that the presence of that heated drying fluid would be “inconsistent with” all air in the drying chamber being below 100°C. Tr. 34:21–35:2.

The Specification explains that air introduced into the drying chamber is hotter than air leaving the drying chamber in both the prior art and claimed systems. The Specification describes the cooling of the drying fluid in a prior art system as follows:

One of the prominent attributes of the traditional spray drying process is the high temperature of the inlet gas (typically on the order of 200° C.) leaving the heater 11 and entering the drying chamber 7, as well as the temperature of the outlet gas exiting the drying chamber 7, which is usually in excess of 100° C.

Id. at 2:8–14. The Specification describes a similar cooling effect within the drying chamber of the claimed system as follows: “It has been demonstrated that an inlet air temperature of about 40° C. may result in an outlet air temperature of about 32° C. from the drying chamber 107.” *Id.* at 7:35–37. Based on these disclosures, we understand that drying fluid is hotter at the inlet than it is at the outlet. Accordingly, claims that recite the temperature of drying fluid “at introduction into the drying chamber,” e.g., claims 4 and 5, effectively limit the highest permitted temperature of the drying fluid, which includes “air,” at any point in the drying chamber. Claim 1 recites an upper limit of 100°C on the temperature of one component of the drying fluid, “air,” without limiting the location at which the temperature is measured. We conclude, therefore, that the upper limit of 100°C as recited in claim 1 refers to the temperature of air measured at any location within the drying chamber, including at the outlet.

Petitioner proposes that the broadest reasonable interpretation of “the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C” requires that “at some location within the internal volume of the drying chamber there is air at a temperature

that is above the freezing temperature of the liquid solvent and below 100°C.” Pet. 7–8 (citing Ex. 1010 ¶ 46). Based on our review of claims 1–5 and the Specification, we adopt Petitioner’s interpretation.

2. Dried Powder Containing the Active Ingredient Encapsulated Within the Carrier

The preamble of claim 1 recites: “A system for spray drying a liquid product into a dried powder.” Ex. 1001, 12:55–56. Petitioner asserts without analysis in the Petition that the preamble of claim 1 is not a limitation. Pet. 11, 23. Patent Owner implicitly interprets the preamble as requiring Petitioner to demonstrate that the asserted prior art described dried powder emerging from the spray-drying apparatus without further processing. See PO Resp. 40–41 (arguing that neither DeRoos nor Skelbæk describe spray drying that produces a dried powder and that both references require further drying in a fluidized bed). Patent Owner’s argument rests upon a premise that claim 1 is limited to systems that use spray drying to “achieve a dried product.” *Id.* at 46. Petitioner replies that “dry” powder does not require absolute dryness and that the powder resulting from Skelbæk’s spray drying process is “dry” even though it is “subjected to further drying” in the fluidized bed. Reply 9 (citing Ex. 1008, 7:5–10).

Like the preamble, the body of claim 1 also refers to “dried powder” once when describing a capability of the claimed “atomizer” as follows: “an atomizer adapted . . . to discharge atomized liquid product into the drying chamber for contact with the drying fluid to form the dried powder containing the active ingredient encapsulated within the carrier.” Ex. 1001, 12:60–65. The body of the claim thus describes the “dried powder” as encapsulating an active ingredient. Regardless of whether the preamble of claim 1 is limiting, it is apparent that the body of claim 1 limits its atomizer

to one that is capable of forming “a dried powder containing the active ingredient encapsulated within the carrier.” Essentially, the same phrase is also affirmatively recited as a limitation in claims 29 and 30. Claim 29 is directed to a “method of forming a dry powder comprising an active ingredient encapsulated within a carrier,” *id.* at 16:24–25, and requires “atomizing the slurry . . . to form the dried powder containing the active ingredient encapsulated within the carrier,” *id.* at 16:32–35. Claim 30 recites “[a] dried powder containing an active ingredient encapsulated within a carrier, formed by the method of claim 29.” *Id.* at 16:36–37.

The Specification describes dried powder in a similar manner to the way the body of claim 1 describes it. For example, the Specification states: “As the water evaporates, the carrier forms a hardened shell around the load, producing a dried powder.” *Id.* at 1:42–43. The Specification also states that the claimed spray-dryer suspends wet particles “for a sufficient time to drive off a sufficient amount of the liquid solvent within most of the wet particles to leave a plurality of dried particles (the powder), each dried particle containing the active ingredient encapsulated within the carrier.” *Id.* at 2:56–61. The Specification also includes magnified images of “dried powder” that emerges from the claimed spray-drying system, Figures 7–10, which illustrate the powder as encapsulating, for example, “flavor oil droplets, in the micron-diameter range.” *Id.* at 11:40–42, 11:58–60. The Specification thus indicates that the dried powder may contain liquid active ingredients. At no point, however, does the Specification define “dried” as it relates to the amount of solvent remaining in the particles when they emerge

from the spray-drying apparatus. Neither party adduces evidence on this point.¹¹

Based on our review of the plain language of claims 1, 29, and 30 and the Specification, we conclude that “dried powder containing the active ingredient encapsulated within the carrier” refers to particles with an outer shell sufficiently devoid of solvent so that the particles encapsulate liquid active ingredients. No further limitation on the presence of solvent remaining in the particles is recited.

B. The Parties’ Post-Institution Arguments

In our Institution Decision, we concluded that the argument and evidence adduced by Petitioner demonstrated a reasonable likelihood that claims 1, 16, 19, and 28–30 were unpatentable as anticipated or obvious based on the challenges identified in the table in Part I.D above. Dec. 11–28. We must now determine whether Petitioner has established by a preponderance of the evidence that the specified claims are unpatentable over the cited prior art. 35 U.S.C. § 316(e). In this connection, we previously instructed Patent Owner that “any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived.” Paper 12, 7. Additionally, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

¹¹ At the oral hearing, the parties represented that neither any party nor any expert witness had defined “dry,” and that little, if any, evidence existed in the record to establish the meaning of dry. Tr. 59:14–25, 74:11–12.

C. Principles of Law

To prevail in its challenges to the patentability of the claims, Petitioner must prove unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

To establish anticipation, each limitation in a claim must be found in a single prior art reference, arranged as recited in the claim. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). While the limitations must be arranged or combined in the same way as in the claim, identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990). Moreover, a reference anticipates a claim “if it discloses the claimed invention such that a skilled artisan could take its teachings in combination with his own knowledge of the particular art and be in possession of the invention.” *In re Graves*, 69 F.3d 1147, 1152 (Fed. Cir. 1995). Thus, “it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.” *In re Preda*, 401 F.2d 825, 826 (CCPA 1968).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the claimed subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

(3) the level of skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

*D. Claims 1, 16, and 19:
Anticipation by Merritt*

Petitioner contends that Merritt anticipates claims 1, 16, and 19. Pet. 11–16, 18–20. We have reviewed Petitioner’s explanation identifying where Merritt describes each limitation of claims 1, 16, and 19 along with the proffered testimony of Petitioner’s declarant, Dr. Brahms. *Id.*; Ex. 1010 ¶¶ 57–59. We have also reviewed Patent Owner’s argument and evidence that Petitioner’s contentions are deficient. PO Resp. 38–39.

1. Overview of Merritt

Merritt relates to “encapsulation of water-insoluble active materials such as essential oils, oleo resins and imitation flavors and fragrances, in a matrix of hydrolyzed starch or hydrolyzed dextrin.” Ex. 1005, 1:36–39. Merritt discloses the steps of admixing encapsulating material and active material in water and spray-drying the resulting dispersion without injecting carbon dioxide into the dispersion. Suitable dispersions have solids concentration of 60 to 95% prior to spray drying, with a viscosity of 300–20,000 cps, measured at 70°C. *Id.* at 2:23–40. Feed pressure can range from 150–20,000 psi, with a relatively large orifice and a relatively small vortex creating device. *Id.* at 3:64–65, 4:11–17. Sugar is disfavored as an encapsulating material because it is hygroscopic. *Id.* at 4:51–53. The examples include spraying dispersions “through a #56 orifice and #416 core with inlet temperature of about 400°F. and outlet temperature of about 200°F [93.3°C].” (Example VII) and “through a #56 (0.0465”) nozzle orifice, Spraying Systems #220 core with inlet and outlet temperatures of 370°F and 200°F [93.3°C], respectively” (Example VIII). *Id.* at 8:7–10, 9:23–26. The

resulting dried particles were spherical, elongate, or rod-shaped based on various factors. *Id.* at 8:28–39, 9:30.

2. Analysis

a. Independent Claim 1

In the Petition, Petitioner alleges how each limitation of independent claim 1 would have been understood to be disclosed by Merritt. Pet. 11–15, 18–20. Patent Owner contends that Merritt fails to describe the claimed limitation on the temperature of the air in the drying chamber and does not dispute that Merritt describes the remaining limitations of claim 1. PO Resp. 38–39.

For the undisputed claim limitations, we agree with and adopt Petitioner’s assertions. In particular, with respect to the preamble, we find that Merritt prepares a dry, rod-shaped particulate material by spray-drying a dispersion of an active compound in an aqueous solution of encapsulating material. Ex. 1005, Abstract. With respect to the limitation “a drying chamber, including an inlet end, an outlet end, and an internal volume within which the liquid product is dried in contact with a drying fluid therein,” we find that Merritt discloses corresponding structure as “a pilot plant box spray dryer of 12'x8'x8',” with an inlet and an outlet, in which the spray-dried dispersion is in contact with air. *Id.* at 3:63–68, 4:15–17, 7:24–26, 8:7–9. With respect to the limitation “an atomizer adapted to receive the liquid product in a form including a liquid solvent, a carrier, and an active ingredient, and to discharge atomized liquid product into the drying chamber for contact with the drying fluid to form the dried powder containing the active ingredient encapsulated within the carrier,” we find that Merritt

discloses a nozzle for spraying the dispersion into the drying chamber. *Id.* at 4:11–14, 7:7, 8:40.

With respect to the limitations “further comprising a source of said liquid solvent, a source of carrier, and a source of active ingredient(s), a tank equipped with a stirring device and arranged to receive liquid solvent, carrier,” we find that Merritt describes such agitating in a tank of lemon oil, water, and maltrin-10 from sources thereof. *Id.* at 2:24–27, 1:10–14, 4:54–55, 7:7–17, 7:34–8:7. With respect to “active ingredient(s) from said sources to form the liquid product comprising a slurry having viscosity in a range of from 500 to 16,000 mPa-s, wherein the liquid solvent comprises water,” we find that Merritt discloses a viscosity of 300 cps and preferably at least 500 cps, measured at 70°C, with a maximum viscosity of 20,000 cps. *Id.* at 2:33–40, 8:20–23, claim 1.

With respect to the limitation “wherein the liquid solvent comprises water,” we find that Merritt discloses admixing encapsulating material and active material in water. *Id.* at 2:24–27, 7:7–9, 7:43, 7:66–8:5, claim 1. With respect to “wherein the carrier comprises starch,” we find that Merritt discloses that Suitable encapsulating materials include hydrolyzed starch. *Id.* at 4:54–5:59, 7:7–9, 7:44, 8:5–7, claim 1, claim 3. We note that we consider Merritt’s “hydrolyzed starch” to meet the “starch” element of independent claim 1, not only because it is undisputed, but also because the Specification of the ’388 patent indicates that the starch of the claimed invention is in the form of a modified starch. *See* Ex. 1001, 1:25, 6:61.

The parties’ dispute focuses on whether Merritt describes air in its drying chamber that meets the limitation “wherein the drying fluid comprises air at temperature that is above freezing temperature of the liquid

solvent and below 100°C.” Petitioner relies on Example I of Merritt which discloses an outlet temperature of 210° F. (99°C), down from an inlet temperature of 380° F. (193°C). *See* Ex. 1005, 7:24–27. Petitioner also relies on Example VII of Merritt which discloses an outlet temperature of about 200° F (93°C), down from an inlet temperature of about 400° F. (204° C). *Id.* at 8:7–9. Patent Owner asserts that the temperature of air at Merritt’s inlet is significantly above 100°C for all examples, i.e., 193.3°C, 204.4°C, and 187.8°C, and argues that Merritt, therefore, fails to meet the limitation that air in the drying chamber be “below 100°C.” PO Resp. 39.

As set forth in Part II.A above, we interpret the temperature limitation of claim 1 to refer to the temperature of air at any location within the drying chamber, including at the outlet. Applying this claim interpretation, we find that Merritt’s disclosure of outlet temperatures of 93°C and 99°C meets the temperature limitation recited in claim 1. For the reasons discussed above, we find that Merritt anticipates independent claim 1.

b. Dependent Claims 16 and 19

Claim 16 depends from claim 1 and further recites “a nozzle operating to atomize the liquid product comprising a slurry to produce a plurality of wet particles as said atomized liquid product discharged into the drying chamber for contact with the drying fluid.” Ex. 1001, 14:38–42. Claim 19 depends from claim 16 and further recites:

wherein the nozzle includes an inlet for receiving a source of pressurized, drying fluid and an outlet end including a plurality of channels operating to direct the drying fluid to swirl as it leaves the nozzle, thereby imparting a swirling agitation to the plurality of wet particles as they leave the nozzle.

Id. at 14:51–56.

Petitioner explains how Merritt describes the limitations introduced in claims 16 and 19. Pet. 15, 18–22. Patent Owner contends that Merritt fails to describe the temperature limitation recited in claim 1 and does not contend that Merritt fails to describe the limitations introduced in dependent claims 16 and 19. PO Resp. 38–39.

With respect to the undisputed limitations of dependent claims 16 and 19, we agree with and adopt Petitioner’s assertions. Pet. 15, 18–22. As explained in Part II.D.2.a above, we find that Merritt’s spray drying system meets the temperature limitation of claim 1. Accordingly, we find that Merritt also anticipates claims 16 and 19.

*E. Claims 1, 16, and 19:
Obviousness over Merritt, Dobry, and Skelbæk*

Petitioner contends that the combination of Merritt, Dobry, and Skelbæk renders claims 1, 16, and 19 unpatentable as obvious. Pet. 33–38, 41–45. We have reviewed Petitioner’s explanation identifying where the asserted prior art describes each limitation of claims 1, 16, and 19, along with the proffered testimony of Dr. Brahms. *Id.*; Ex. 1010 ¶¶ 93–113. We have also reviewed Patent Owner’s argument and evidence that Petitioner’s contentions are deficient. PO Resp. 44–47.

1. Overview of Dobry

Dobry is a research article which “describes the basic spray-drying process-development methodology, which employs a series of screening-scale spray-drying runs, offline experiments, and fundamental models, leading to quick and efficient initial process definition.” Ex. 1006, 2. Dobry sets forth thermodynamic equations relating the drying-gas outlet temperature (T_{out}) to solution feed rate (M_{soln}), the drying-gas flow rate (M_{gas}), the energy required to vaporize the solvent, the heat of vaporization

(ΔH), the mass fraction solids in solution (x_{solids}), the energy lost by the drying gas (ΔE), the heat capacity (c_p) of the drying gas, and the relative humidity measured at the sprayer-dryer outlet. In these equations, Equation (4), below, can be solved for T_{out} as a function of M_{soln} , M_{gas} , and T_{in} .

$$T_{\text{out}} = T_{\text{in}} - \frac{M_{\text{soln}} \times (1 - x_{\text{solids}}) \times \Delta H_{\text{vap}}}{M_{\text{gas}} \times c_p} \quad (4)$$

Equation (4) thus allows for calculation of dryer output conditions based on the other variables. *Id.* at 6. Dobry discloses that further modeling and simulations may be performed, maximizing droplet sizes with acceptable flow properties. *Id.* at 6–8. Dobry provides examples of drying kinetics that produce spherical droplets at T_{in} of 65°C and raisin-shaped particles at lower gas temperatures. *Id.* at 8. Droplet size is a function of viscosity, surface tension, atomizer geometry, nozzle pressure, and M_{soln} . *Id.* at 9. Dobry discloses that nozzle and operating pressure are selected based on target droplet size and feed rate. *Id.* at 9.

Dobry identifies four constraints that are considered to optimize design of a process: (1) the minimum specific drying ratio ($M_{\text{soln}}/M_{\text{gas}}$) is defined based on requirements for processing time; (2) T_{out} is determined based on thermal degradation/inactivation of the product, and previous observations thereof, e.g., 50°C; (3) Maximum T_{in} is defined based on product specifications, i.e., to prevent sticking of product to spray-dryer; and (4) Minimum T_{out} is determined based on the relationship of relative humidity to the glass transition temperature (T_g). *Id.* at 6.

Finally, Dobry suggests hot-bench “Verification Spray-Drying Experiments (Optional),” but states that “[t]he need for model validation cannot be understated.” *Id.* at 8 n.4, 9.

2. *Overview of Skelbæk*

Skelbæk “relates to a process for preparing microcapsules containing a flavourant embedded in a matrix material comprising spraying an aqueous emulsion, suspension or solution of the flavourant and the matrix material under the supply of air to form a free-flowing product.” Ex. 1008, 1:4–8. Skelbæk explains that hot air temperatures can create porous particles due to a steam explosion, and that this porosity can lead to oxygen reacting with the flavorant. *Id.* at 2:11–23, 2:35–40. Skelbæk discloses a method of spraying where “the aqueous emulsion, suspension or solution of a flavourant and matrix material is sprayed under the supply of air having a temperature of 50 to 120°C while simultaneously introducing a spraying agent.” *Id.* at 2:28–31. The sprayed product leaves the drying chamber as microcapsules, which are then subjected to additional drying in a fluidized bed at a temperature between 0 and 120°C. *Id.* at 7:4–11. Skelbæk also describes ten specific examples of its process using air at temperatures of 65–85°C in the spray-drying step. *See id.* at 7:16–14:25 (Examples 1–6), 16:1–19:22 (Examples 8–11). In every one of these ten examples, particles leaving the spray-dryer with “freshly solidified surfaces” were subjected to additional drying in a fluidized bed. *Id.*

3. *Analysis*

a. *Independent Claim 1*

Petitioner’s challenge to claim 1 as being obvious in view of the combination of Merritt, Dobry, and Skelbæk, is based largely upon the same comparison of Merritt to the claim. *See* Pet. 33–37, 41–42. Nevertheless, Petitioner states, and we agree, that “[i]f there is any question about whether low temperature spray drying could be used in the encapsulation of active

ingredients in a carrier, Skelbæk teaches the advantages of drying liquid drops under the supply of air having a temperature of 50–120°C.” Pet. 37 (citing Ex. 1008, Abstract, pg. 2–3.). We further agree with the rationale of Petitioner that the advantages that would have been obvious to an ordinarily skilled artisan from using the lower temperature range of Skelbæk with Merritt are “a denser, non-permeable matrix material” and to “retain high levels of flavorant.” *Id.* (citing Ex. 1010 ¶ 107). In addition to relying on Merritt and Skelbæk, Petitioner cites Dobry’s Figure 1 in its claim chart, which schematically illustrates a conventional spray-drying system.¹² See Pet. 41–42.

Patent Owner’s principle argument against obviousness over Merritt, Dobry, and Skelbæk is the same as its argument against anticipation by Merritt, i.e., that Merritt includes gas above 100°C as well as below 100°C. We have rejected this argument as a matter of claim interpretation, for the reasons set forth in Part II.D.2.a above.

In addition, Patent Owner asserts that Skelbæk may not be relied upon by Petitioner for the teaching of the use of a lower temperature drying fluid in a drying chamber because Skelbæk’s spray drying process yields partially dried material that requires further drying. PO Resp. 46 (citing Ex. 1008, 6:20–24). In particular, Patent Owner points out that Skelbæk uses a fluidized bed to dry further the product leaving Skelbæk’s spray drying process. *Id.*

¹² Dobry’s Figure 1 is virtually identical to Figure 1 in the ’388 patent. Compare Ex. 1007, Fig. 1 with Ex. 1001, Fig. 1. Figure 2 of the ’388 patent is virtually identical to Figure 1 of the ’388 patent, but merely replaces the “process heater” of Figure 1 with a “process dehumidifier.” Compare Ex. 1001, Fig. 2 with *id.* at Fig. 1.

However, we note that Petitioner relies upon Skelbæk to establish that an ordinarily skilled artisan would have known that using a lower temperature drying fluid was advantageous because it helped to preserve high levels of the flavorant. Pet. 37 (citing Ex. 1010 ¶¶ 107, 108). Moreover, we determine that Skelbæk’s spray-drying process results in “dried powder” as we have interpreted that phrase in Part II.A.2 above. Skelbæk’s spray-drying process generates microcapsules with “freshly solidified surfaces,” *see* Ex. 1008, 7:16–14:25 (Examples 1–6), 16:1–19:22 (Examples 8–11), which are “substantially non-permeable to both the flavourant enclosed in the matrix material and to the oxygen contained in the ambient air,” *id.* at 3:8–10. Such microcapsules meet the claimed requirement of forming “dried powder containing the active ingredient encapsulated within the carrier.” Skelbæk’s suggestion to use lower temperature drying fluid in a spray-drying process that also generates a “dried powder” strongly suggests the obviousness of using such lower temperatures.

Petitioner’s reliance upon Dobry is virtually redundant to the teachings of Merritt and Skelbæk, and Petitioner proffers Dobry to bolster its argument that, to an ordinarily skilled artisan, Merritt (which does not include any figures) sufficiently describes the hardware components of a spray-drying system. Pet. 33–35. Although Patent Owner does not dispute that Dobry discloses the hardware components of a spray-drying system, Patent Owner argues that Dobry does not provide a basis for experimentation with drying fluid temperatures because Dobry’s theoretical model for spray drying is based on near-equilibrium assumptions, does not account for kinetic limitations, and reminds that the “need for model

validation cannot be understated” and that “model output should be validated using off-line experiments and placebo trial runs.” PO Resp. 45 (citing Ex. 1006, 6, 7 n.4). We find Patent Owner’s argument unpersuasive because Dobry need not be relied upon to teach the claimed temperature ranges which, as explained above, we determine are disclosed by Merritt and Skelbæk.

For all these reasons, we find that Petitioner has established by a preponderance of evidence that the combination of Merritt, Dobry, and Skelbæk renders independent claim 1 unpatentable as obvious.

b. Dependent Claims 16 and 19

Petitioner contends that all limitations of claims 16 and 19 are disclosed by the combination of Merritt, Skelbæk, and Dobry and that an ordinarily skilled artisan would have combined the teachings of all three references in arriving at the claimed subject matter. Pet. 31–38, 41–43. Petitioner contends, and we agree as stated in Part II.D.2.b above, that Merritt describes the nozzle that is introduced in claims 16 and 19. Patent Owner reiterates its argument that the prior art fails to describe the temperature limitation recited in independent claim 1 but does not contend that the prior art fails to describe the limitations introduced in dependent claims 16 and 19 or dispute whether an ordinarily skilled artisan would have had reason to combine teachings of the asserted prior art. PO Resp. 44–47.

With respect to those limitations added in claims 16 and 19, we agree with and adopt Petitioner’s contentions. Pet. 37–38, 43. As explained in Part II.D.2.a above, we find that Merritt’s spray drying system meets the temperature limitation of claim 1. We also determine that Petitioner has persuasively established that an ordinarily skilled artisan would have had

reasons to combine the teachings of Merritt, Skelbæk, and Dobry to arrive at the subject matter of claims 16 and 19 because the combination would result in a “denser, non-permeable matrix material” and would “retain high levels of flavorant,” as explained above. Thus, we conclude that the combination of Merritt, Dobry, and Skelbæk renders dependent claims 16 and 19 unpatentable as obvious.

F. Claim 28:

Obviousness over Merritt, Dobry, and Watanabe

Petitioner contends that the combination of Merritt, Dobry, and Watanabe renders claim 28 unpatentable as obvious. Pet. 33–45; Reply 2–10. We have reviewed Petitioner’s explanation identifying where the asserted prior art describes each limitation of claim 28, along with the proffered testimony of Dr. Brahms. *Id.* We have also reviewed Patent Owner’s argument and evidence that Petitioner’s contentions are deficient. PO Resp. 47–49.

1. Overview of Watanabe

Watanabe discloses a method for producing a dry powder from a hydrous liquid with a flavorful component, preferably hygroscopic, by spray drying the hydrous liquid material at the microfine liquid droplet state in a gas atmosphere having a relative humidity of 1% RH to 40% RH, to prepare a dry powder of a mean particle size of 0.1 μm to 15 μm . Ex. 1011, at [57], ¶¶ 19, 46. The inlet temperature of the spray dryer is 50 to 120°C, particularly preferably 60 to 80°C. The outlet temperature of the spray dryer for use in accordance with the invention is 20 to 90°C, particularly preferably 35 to 50°C. *Id.* ¶ 47. Watanabe suggests, for example, dehumidifying air to a relative humidity of 1% and heating that air to 80°C before injecting it into a spray drying process. *Id.* ¶ 64.

2. Analysis

Claim 28 depends from claim 1 and recites “further comprising a dehumidifier arranged to dehumidify the drying fluid prior to its flow through the drying chamber.” Ex. 1001, Certificate of Correction. Petitioner relies on Watanabe as describing the use of a dehumidifier as part of a spray drying process and argues that it would have been obvious to combine Watanabe’s dehumidifier with the teachings of Merritt and Dobry as the combination of known elements by known methods with no change in their respective functions, where the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. Reply 7 (citing Ex. 1011 ¶¶ 41, 64). Watanabe’s dehumidifier performs the same function as the claimed dehumidifier in the same type of system, a spray-drying tower, that is claimed and also described in Merritt and Dobry. Additionally, Dobry explains the benefits of lowering the humidity of the drying fluid. See Ex. 1007, 5. Patent Owner argues that Watanabe, Dobry, and Merritt are “fundamentally different,” are not “analogous” to one another, and that Watanabe’s spray-drying process uses excipients. PO Resp. 48.

Patent Owner’s argument is unpersuasive because Watanabe’s use of excipients does not diminish Watanabe’s express suggestion to use a dehumidifier in a spray drying process. Rather, we agree with Petitioner that an ordinarily skilled artisan would have understood that a dehumidifier can be used for dehumidification purposes in spray-drying processes, even when the materials being dried differ. Further, we find that Watanabe, Merritt, and Dobry are all analogous art to the claimed invention (and to one another)

inasmuch as they relate to the field of spray drying and the problem of drying. *See In re Bigio*, 381 F.3d 1320, 1325–26 (Fed. Cir. 2004).

Based on our review of the entire record before us, we determine that Watanabe describes the use of a dehumidifier as required in the system of dependent claim 28. For the same reasons expressed in Part II.D.2.a above, we find that Merritt’s spray drying system meets the temperature limitation recited in claim 1. We also determine that Petitioner has persuasively established that an ordinarily skilled artisan would have had reasons to combine the teachings of Merritt, Dobry, and Watanabe, including the benefit of using dehumidified air in the drying chamber, to arrive at the subject matter of claim 28. Thus, we conclude that Petitioner has established by a preponderance of evidence that the combination of Merritt, Dobry, and Watanabe renders dependent claim 28 unpatentable as obvious.

G. Claims 29 and 30:

Obviousness over Merritt, Dobry, Skelbæk, and Watanabe

Claim 29 recites:

29. A method of forming a dry powder comprising an active ingredient encapsulated within a carrier, said method comprising:

providing a system according to claim 28;

forming the slurry in the mixing tank from the liquid solvent, carrier, and active ingredient(s) while stirring the mixing tank with the stirring device;

atomizing the slurry in the atomizer and discharging atomized slurry into the drying chamber for contact with the drying fluid to form the dried powder containing the active ingredient encapsulated within the carrier.

Ex. 1001, 16:23–33. Claim 30 depends from claim 29 and recites “[a] dried powder containing an active ingredient encapsulated within a carrier, formed by the method of claim 29.” *Id.* at 16:34–35.

Petitioner contends that the combination of Merritt, Dobry, Skelbæk, and Watanabe renders claims 29 and 30 unpatentable as obvious. Pet. 33–45; Pet. Reply 2–10. Patent Owner argues for patentability of claims 29 and 30 on the same grounds offered in connection with its arguments for patentability of claims 1 and 28, which we have found unpersuasive for reasons expressed in Parts II.D–F above.

With respect to the limitations introduced in claims 29 and 30, we find, as above, that Merritt discloses methods that include dissolving an encapsulating material in water, adding an active material and agitating to form a homogenous dispersion, and spray drying the dispersion through a nozzle into a spray-drying chamber to form a dry powder. Ex. 1005, Abstr., 3:25–40, claim 9. For the same reasons expressed in Part II.D.2.a above, we find that Merritt’s spray drying system meets the temperature limitation recited in claim 1. For the reasons expressed in Parts II.E.3 and II.F.2 above, we also determine that Petitioner has persuasively established that an ordinarily skilled artisan would have had reasons to combine the teachings of Merritt, Dobry, Skelbæk, and Watanabe to arrive at the subject matter of claims 29 and 30. Thus, we conclude that dependent claims 29 and 30 would have been obvious to a person of ordinary skill in the art over the combination of Merritt, Dobry, Skelbæk, and Watanabe.

H. Claims 1, 16, and 19:

Obviousness over DeRoos, Dobry, Skelbæk, and Tanaka

Petitioner contends that the combination of DeRoos, Dobry, Skelbæk, and Tanaka renders claims 1, 16, and 19 unpatentable as obvious. Pet. 20–

33. We have reviewed Petitioner's explanation identifying where the asserted prior art describes each limitation, along with the proffered testimony of Dr. Brahms. *Id.*; Ex. 1010 ¶¶ 56–81. We have also reviewed Patent Owner's argument and evidence that Petitioner's contentions are deficient. PO Resp. 40–44.

1. Overview of DeRoos

DeRoos discloses a method for encapsulating an active ingredient (such as a flavor, fragrance, or vitamin) in a glassy matrix to form a free-flowing, dust-free particle. Ex. 1006, at [57], 3:13–27. The method uses lower product exposure temperatures than during standard spray drying. *Id.* at 5:8–14. This improves flavor retention, reduces thermal decomposition of sensitive flavors and, further, enhances shelf life stability by reducing the matrix porosity resulting from expansion and ballooning that take place at high drying rates. *Id.*

The matrix is composed of at least one low molecular weight water soluble molecule such as a carbohydrate or polyhydroxy compound, and at least one high molecular weight film forming agent such as protein, gum acacia, pectin, modified starch, and/or a polyglycerol fatty acid ester. *Id.* at 3:28–33. The slurry emerges from the spray drying tower as “particles with a skin that is still permeable for water but no longer permeable for flavorants.” *Id.* at 6:2–5. DeRoos refers to these particles as “powder” that “is fluidized in the internal fluid bed.” *Id.* at 6:16–17.

The particles formed are dried further, for example in a fluid bed or moving belt dryer, at an air temperature sufficient to render the matrix material permeable to water but impermeable to the active ingredient. The

particles are further dried at an air temperature of about 25–55°C, lower than previously used, resulting in free-flowing dust free particles. *Id.* at 3:18–27.

In particular, the process steps are as follows:

a) forming an aqueous solution which contains, on a solid basis, from 40–70% by weight of at least one low molecular weight carbohydrate and/or polyhydroxy compound, and 30–60% by weight of at least one high molecular weight film forming agent, whereby the aqueous solution contains at least 50% by weight of said agent(s);

b) incorporating at least one active ingredient into the solution of step a) and building an emulsion or suspension, whereby said emulsion or suspension contains, on a non-aqueous basis, between 1–35% by weight of the active ingredient(s);

c) spray drying the emulsion or suspension of step b) into a spray drying tower at an air inlet temperature of 100–180°C and an air outlet temperature of 60–95°C;

d) transferring to a fluid bed section the resulting surface dried semi-solid microparticles of step c) having a water content of about 10–20% by weight and having a particle size of about 10–200 μm , and continuing drying and simultaneously agglomerating said microparticles at an air temperature of between 25–55°C, especially at about 40–50°C, resulting in solid, free-flowing particles with a glassy matrix having mainly a size of 400 μm or lower and having a water content of about 2–6% by weight; and

e) collecting the particles of step d), at least 90% by weight of the particles having a size in the range of 100–400 μm and a water content of 0.5–4% by weight, and (simultaneously) recycling the particles having a size mainly below about 100 μm (fines) from the fluid bed either into the spray drying tower to allow growth of these particles by wetting the particles with freshly sprayed-in emulsion or suspension of step b), or to the upper part of the fluid bed to allow growth of these particles by agglomeration to a size in the range of 100–400 μm .

Id. at 4:19–55.

2. Overview of Tanaka

Tanaka discloses a spray drying apparatus equipped with a spray nozzle unit, having a pressure nozzle and a cylindrical outer tube disposed around the pressure nozzle. Ex. 1009, at [54], [57]. A gas is blown at high speed through the annulus formed between the pressure nozzle and the cylindrical outer tube so as to atomize water into very fine droplets even when only low pressure, which would otherwise produce coarse droplets, is applied in the pressure nozzle. *Id.* at 2:7–14.

3. Analysis

In the Petition, Petitioner alleges how each limitation of claims 1, 16, and 19 would be understood to be disclosed by the combination of DeRoos, Dobry, Skelbæk, and Tanaka. Pet. 20–33. Patent Owner disputes whether the asserted prior art describes certain claim limitations. PO Resp. 40–44. We address the claim limitations that are in dispute below.

a. Independent Claim 1

For the undisputed claim limitations, we agree with and adopt Petitioner's assertions. Petitioner relies primarily upon DeRoos as describing every limitation of claim 1. Pet. 23–26. Petitioner relies upon Skelbæk as further evidence that an ordinarily skilled artisan would be motivated to use cooler temperatures for the drying fluid in DeRoos's drying chamber to retain higher levels of flavorant (active ingredient) in the particles that emerge from a spray dryer. *Id.* at 25–26. Petitioner relies upon Dobry as reflecting the manner in which an ordinarily skilled artisan would have interpreted DeRoos's references to elements of a spray-drying tower. *Id.* at 23–24. Petitioner does not rely upon any teachings in Tanaka to make

its case for obviousness.¹³ Each of DeRoos, Dobry, and Skelbæk are directed to the same field of endeavor, spray-drying processes, and we are persuaded that an ordinarily skilled artisan would have looked to all three references as being readily combinable.

In particular, with respect to the preamble and the limitations “a drying chamber, including an inlet end, an outlet end, and an internal volume within which the liquid product is dried in contact with a drying fluid therein,” we find that DeRoos discloses a multi-stage spray drying unit, with an inlet and an outlet, for spray-drying an emulsion or suspension (of an active ingredient in an aqueous solution of matrix materials) with air to form a powder. Ex. 1006, 4:14–56, 5:31–33.

With respect to the undisputed limitations “further comprising a source of said liquid solvent, a source of carrier, and a source of active ingredient(s),” we further find that DeRoos discloses corresponding structure with the use of lemon oil as an active ingredient, water as a solvent, and maltodextrin as a carrier to form an emulsion, and that DeRoos uses a pressure nozzle to spray the emulsion into the spray drying chamber. *Id.* at 6:60–7:10, 7:20–7:23, 7:40.

With respect to the undisputed limitations “a tank equipped with a stirring device and arranged to receive liquid solvent, carrier, and active ingredient(s) from said sources to form the liquid product comprising a

¹³ Although Petitioner does not rely on Tanaka for any of the limitations of independent claim 1 or dependent claim 16, Petitioner includes Tanaka in the combination of teachings that would render each of claims 1, 16, and 19 obvious. *Compare* Pet. 22, *with id.* at 26. We instituted a trial based on the combination of DeRoos, Dobry, Skelbæk, and Tanaka for all three claims. Dec. 22, 28.

slurry having viscosity in a range of from 500 to 16,000 mPa-s, wherein the liquid solvent comprises water, wherein the carrier comprises starch,” we find that DeRoos discloses corresponding structure when stirring the flavorant into an aqueous solution of matrix materials (including maltodextrin)¹⁴ to form an emulsion, preferably adjusted to a viscosity of about 400–1000 cP at 40°C. *Id.* at 5:31–33, 5:53–57, 6:62–6:65, 7:58–7:60.

With respect to the recited requirement that “the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C,” Petitioner relies on DeRoos’s disclosure of air in the outlet of the spray-drying unit of 60–65°C (based on an inlet temperature of 100–180°C) and air in the outlet at 70–73°C (based on an inlet temperature of 130–150°C or 145–165°C). Pet. 25, 31. Patent Owner argues that because the inlet temperature is above 100°C, DeRoos fails to meet the claimed limitation on the temperature of the air in the drying fluid. PO Resp. 40. Based upon our interpretation of the claimed temperature limitation on the air in the drying fluid, we find that DeRoos meets that limitation because DeRoos describes air cooler than 100°C in at least some portion of the drying chamber.

With respect to the limitation “an atomizer adapted to receive the liquid product in a form including a liquid solvent, a carrier, and an active ingredient, and to discharge atomized liquid product into the drying chamber for contact with the drying fluid to form the dried powder containing the active ingredient encapsulated within the carrier,” Petitioner relies on the spray drying chamber of DeRoos and its spray nozzle. Ex. 1006, 6:60–7:10,

¹⁴ Maltodextrin is derived from starch.

7:20–7:23, 7:40. However, Patent Owner argues that the spray drying processes of both DeRoos and Skelbæk produce a “wet” product that requires further drying in a fluidized air bed after the spray drying process. PO Resp. 40–41 (citing Ex. 1005, 4:35–37; Ex. 1007, 6:20–24). On this basis, Patent Owner argues that neither DeRoos nor Skelbæk form dried powder in the drying chamber, as recited in the claims. *Id.* at 42.

We are not persuaded by Patent Owner’s argument because we interpret “dried powder” as used in claim 1 to permit the presence of some solvent so long as the particles that emerge from the spray-drying process encapsulate the active ingredient. Petitioner points out that DeRoos and Skelbæk both describe spray-drying processes that result in particles that encapsulate the active ingredients. Reply 9 (citing Ex. 1006, 4:36–40, 6:25; Ex. 1008, 7:5–10). Our own review of DeRoos and Skelbæk confirms the same. Nothing more is required to meet the “dried powder” limitation of claim 1. *See* Part II.A.2 above. For these reasons, we conclude that Petitioner has shown by a preponderance of evidence that the combination of DeRoos, Dobry, Skelbæk, and Tanaka renders independent claim 1 unpatentable as obvious.

b. Dependent Claims 16 and 19

Petitioner contends that the nozzles of DeRoos (and Skelbæk) meet the limitations introduced in claim 16, and the nozzles of DeRoos and Tanaka meet the limitations introduced in claim 19. Pet. 31 (citing Ex. 1009, 1:54–60, 2:43–60; Ex. 1006, 7:20–23). Patent Owner does not dispute Petitioner’s assertions that the nozzles of DeRoos and Tanaka meet the limitations introduced in claims 16 and 19, but rather argues that Petitioner’s rationale is faulty for the combination of DeRoos, Dobry,

Skelbæk, and Tanaka, as set forth above with respect to independent claim 1. PO Resp. 40–44. We are unpersuaded by Patent Owner’s argument against the rationale for combining teachings of DeRoos, Dobry, and Skelbæk for the reasons expressed above in connection with claim 1. Additionally, Petitioner points out, and we agree, that Tanaka expressly describes a nozzle that directs the slurry in a swirling pattern to improve drying performance in a spray drying process. Pet. 27 (citing Ex. 1010 ¶¶ 79–81). We find that Tanaka’s express teaching would sufficiently motivate an ordinarily skilled artisan to adapt the swirl-inducing nozzle of Tanaka into DeRoos’s spray-drying tower. On the basis of our review of the entire record before us, we conclude that Petitioner has established by a preponderance of the evidence that the combination of DeRoos, Dobry, Skelbæk, and Tanaka renders claims 16 and 19 unpatentable as obvious.

III. CONCLUSION

We conclude that Petitioner has shown by a preponderance of the evidence that (1) claims 1, 16, and 19 are anticipated by Merritt; (2) claims 1, 16, and 19 are obvious over the combination of Merritt, Dobry, and Skelbæk; (3) claim 28 is obvious over the combination of Merritt, Dobry, and Watanabe; (4) claims 29 and 30 are obvious over the combination of Merritt, Dobry, Skelbæk, and Watanabe; and (5) claims 1, 16, and 19 are obvious over the combination of DeRoos, Dobry, Skelbæk, and Tanaka.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1, 16, 19, and 28–30 are unpatentable; and

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

WORTH, *Administrative Patent Judge, Dissenting.*

I. INTRODUCTION

I dissent from the majority's opinion. Rather, I would find that Petitioner has not proven anticipation nor obviousness, for the reasons that follow.

A. Claim Construction

“drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C”

Patent Owner argues that the temperature limitation refers to a range including, and only including, air between freezing temperature and 100°C, contrary to Petitioner, who argues for an open-ended temperature range. In essence, Patent Owner states that the open-ended transition “comprising” in the recital of claim 1 modifies the term “drying fluid” rather than the temperature range. See PO Resp. 30; Tr. 34–38, 63. In other words, Patent Owner asserts that the “drying fluid” of claim 1 comprises air that is confined to a range of temperatures as opposed to air which comprises a range of temperatures. Thus, under Patent Owner's construction, all air in the drying chamber would be below 100°C, for purposes of independent claim 1.

Patent Owner also argues that failure to adopt its proposed construction would result in a construction that is inconsistent with the Specification. PO Resp. 29, 31. In particular, Patent Owner points to statements in the Specification that refer variously to “without applying heat”; “without employing heated air”; “non-heated air”; “a temperature of non-heated drying fluid (air) introduced into the drying chamber 107 may be at least one of: less than about 100°C.; less than about 75°C.; less than

about 45°C.; less than about 35°C.; less than about 30°C.”; “without applying heat”; “non-heated drying fluid”; “a feed of non-heated fluid (such as air or another suitable gas) is supplied into the drying chamber”; “non-heated air may be used”; “without the presence of any heated drying fluids”; “non-heated air”; “no heat spray drying process”; “no-heat drying process”; “no-heat process”; “no-heat powder”; “no-heat samples”; “at about an ambient temperature of a room within which the drying chamber is located”; “40°C”; and “less than 50°C.” PO Resp. 27–29 (referring to Ex. 1001, 4:42–47, 5:45–47, 7:25–37, 1:15–16, 2:62–67, 5:24–26; 5:56, 6:25, 9:38, 9:64, 9:67, 10:3, 10:26, 11:15, 11:24, 11:65, 12:3, 12:8, 12:10, 12:17, 2:63–67, 3:1–3, 7:36, 10:30, 2:47–48).

At oral argument, the panel asked Patent Owner to address how, if at all, the scope of dependent claim 2 might impact the scope of independent claim 1. Tr. 35. Claim 2, which depends from independent claim 1 and is therefore within the scope of independent claim 1, prohibits drying fluids in the range of 180–200°C.¹ *Id.* In particular, the panel asked Patent Owner

¹ Claim 2 recites:

A method for spray drying a liquid product into a dried powder without applying heat, comprising:

providing a system according to claim 1;

forming the liquid product as a slurry including a liquid solvent, a carrier, and an active ingredient;

applying an electrostatic charge to the slurry;

utilizing the atomizer, atomizing the charged slurry to produce a plurality of electrostatically charged, wet particles and discharging the electrostatically charged, wet particles into the drying chamber;

whether claim 2 indicates that it is within the scope of claim 1 to have air above 100°C (but below 180–200°C). *See* Tr. 35. Patent Owner indicated at oral argument that claim 1 refers to air as a drying fluid below 100°C while claim 2 refers to a drying fluid *other than air* that is above 100°C and below 180–200°C. Tr. 35; *see also* Tr. 34–38.

Although a Patent Owner’s statements made post-issuance during an *inter partes* review are not treated as part of the original prosecution history nor otherwise accorded deference in the interpretation of the patent, I agree with the Patent Owner’s statements as being fully consistent with the text of independent claim 1 and its dependent claim 2. Dependent claim 2 refers to “drying fluids” in the plural. As such, dependent claim 2 does not mandate an interpretation of independent claim 1 as including *air* above 100°C.²

suspending the electrostatically charged, wet particles in the drying chamber in contact with the drying fluid for a sufficient time to permit repulsive forces induced by the electrostatic charge on at least some wet particles to cause at least some of such particles to divide into wet sub-particles; and

continuing the suspending step in the drying chamber, without the presence of any heated drying fluids at temperature in a range of 180 to 200° C., for a sufficient time to drive off a sufficient amount of the liquid solvent within most of the wet particles to leave a plurality of dried particles in the dried powder, each dried particle containing the active ingredient encapsulated within the carrier.

Ex. 1001, 13:9–33.

² Although Patent Owner’s argument in this regard was made at oral argument only and not in the written briefing, it was made in response to a question from the panel made only at oral argument. I would accord it weight to the extent that it is consistent with the text of independent claim 1 and dependent claim 2. Inasmuch as the use of an inert gas as a second drying fluid may indicate an undisclosed best mode, that is an issue that is

Further, I agree with Patent Owner that although the term “comprising” is an open-ended transition, the term “comprising” in independent claim 1 modifies “drying fluid” rather than “air.” As such, independent claim 1 leaves open the possibility that more than one drying fluid will be used, as in dependent claim 2, which refers to “drying fluids” in the plural, i.e., indicating that a second gas may be used in addition to air.

Even putting aside the issue of whether more than one drying fluid may be used, I agree with Patent Owner that “comprising” does not follow “air” and does not immediately precede the temperature range. This order of terms in independent claim 1 indicates that the temperature range of the air is not open-ended beyond the top and bottom values recited in independent claim 1, i.e., “temperature that is above freezing temperature of the liquid solvent and below 100°C.” In my view, this reading based on the order of claim terms is confirmed by the Specification for several reasons: (1) the Specification states that there was a problem with the “conventional” (prior art) spray drying process (Ex. 1001, 2:28–44); (2) the Specification describes the prior art process as using temperatures of 180°C–200°C (*id.* at 1:30–40); (3) the Specification states that flavorants would degrade at high temperatures, typically around the order of 200°C (*id.* at 2:8–27); (4) the Specification refers to embodiments and preferred embodiments below 100°C (e.g., *id.* at 7:27–37, 10:26–30); and (5) the Specification does not disclose examples using temperatures above 100°C. This use of the Specification does not read a preferred embodiment into the claim but simply confirms a reading of the claim language itself based on the order of

beyond the scope of an *inter partes* review and also one that relates to an unchallenged claim.

terms in the claim. As such, reliance on the Specification is not necessary to the reading of the claim but confirms a literal reading of the claim language.

Petitioner argues that although the Specification refers to non-heated fluid, air at 100°C cannot be said to be non-heated. Pet. Reply 4. Nevertheless, the Specification indicates that air may be heated as long as it is not heated substantially. See Ex. 1001, 1:14–16 (“The present invention relates to methods and apparatus for spray drying a liquid product into a dried powder without applying heat, or applying substantially low amounts of heat.”). As such, there is no inconsistency—even if air at 100°C is heated applying substantially low amounts of heat, that itself does not require air to be heated higher than 100°C.

Thus, based on the full presentation of the record and the arguments after institution, I agree with Patent Owner that the term “comprising” modifies “drying fluid” rather than “air” and that the temperature range of the air is limited to below 100°C and above freezing. In my view, this is the broadest reasonable interpretation in view of the Specification (and the claim language itself).

“dry powder”; “dried powder”

At the oral hearing, the parties represented that neither party had offered a definition of “dry,” and that there was little, if any, evidence in the record as to the meaning of dry for a person of ordinary skill in the art. See Tr. 59:21–25, 74:11–12. Nor is there a definition from any expert witness. I would note that “dry” in the context of this case means “not wet” but the parties appear to concede that, when dealing with the removal of moisture in a drying process, the point at which a substance has become “dry” may be a

question of degree. *See id.* at 74:14–20. Nevertheless, in the absence of evidence of record, I do not believe it possible to set forth any special construction of “dry powder” other than “powder that is not wet.” As such, the burden on Petitioner for purposes of proving anticipation or obviousness is to prove that the prior art produced powder that is “not wet,” or that it would have been obvious to do so based on the prior art.

It bears mention that the spray drying process involves the drying of droplets that may contain *more than one liquid*. The slurry includes a liquid solvent, a carrier, and an active ingredient. Ex. 1001, 3:49–50. The carrier is usually a modified starch (*id.* at 5:61), the solvent is typically water (see *id.* at 6:2–3), and an example of the active ingredient is an essential oil or flavor oil, *e.g.*, D-Limonene (obtained from orange oil) (*id.* at 12:5–6). In this example, the two liquids are water and the flavor oil (*see id.*). The water and the flavor oil are mixed with the starch to form a slurry, with water at 20–50% by weight (*see id.* at 6:1–16). As the slurry droplets are subjected to the drying process, water evaporates from the droplets and the starch forms fibers (*id.* at 5:30–31; 11:43–54), leaving the active ingredient (flavor oil) encapsulated within the carrier (starch fibers) (*id.* at 2:61). Thus, whether or not the flavor oil is considered to remain in liquid form at the end of the process when it is carried within the starch fibers, the process involves the evaporation of the liquid water (the other liquid). As Patent Owner argues, if the water can still pass through (diffuse) out of the particle, it is still wet. Tr. 61:15–62:22.³

³ Patent Owner was responding at oral argument to an argument Petitioner made for the first time in Petitioner’s Reply Brief, such that Patent Owner

The majority construes “dried powder” variously as a “microcapsule” or a wet particle with a dry skin, or a dry skin that carries liquid inside, based on an argument in the post-institution Reply Brief of Petitioner. *Ante*, slip op. at 12–14. However, the record is ambiguous as to how dry a microcapsule must be to be considered dry, as recognized by counsel at the oral hearing. *See* Tr. 59:17–62:4, 73:16–25. The majority does a careful reading of the Specification which, in explaining (and criticizing) the conventional prior art process, states: “The heated air supplies energy for evaporation of volatile components of the liquid (the water) from the droplets. As the water evaporates, the carrier forms a hardened shell around the load, producing a dried powder” (Ex. 1001, 1:40–44). Nevertheless, in my view, this statement from the Specification does not necessarily define “dried powder” as a “hardened shell around a load” when it says that this process is “producing a dried powder.” *See also* Tr. 74:11–20 (Counsel for Petitioner: “I do agree with the Patent Owner that there is no definition of dry powder. . . . Yes, right, and there is no limitation on dryness anywhere in the patent specification.”).

In any event, there is, in my view, a difference between having a wet droplet with merely a dry skin and having a “hardened shell.” Indeed, the majority points to Figure 10 of the Specification as an example of a microcapsule. However, Figure 10 has more than a dry skin—it has *cross-linking fibers on the inside* as well, as depicted in Figures 9 and 10. *See id.* at 5:1–3 (“FIG. 10 is an image of a cross-section through one of the *dried*

did not previously have an opportunity to respond to Petitioner’s argument on this topic.

powder fibers of FIG. 9 showing encapsulation of load within the carrier”) (emphasis added); *see also id.* at 12:19–45.⁴

The claims do not simply recite a “powder”; rather, they recite a “dry powder” or a “dried powder.” What emerges from the spray drying chamber is a microcapsule with flavor oil in the gaps between fibers of starch after water evaporates from the particle. *See* Ex. 1001, 5:30. That is the difference between wet powder and “dry powder” or “dried powder,” as recited.

II. ASSERTED GROUNDS OF UNPATENTABILITY

A. Anticipation by Merritt

1. Claim 1

As set forth above in the claim construction section, I would construe the temperature range to be limited to “below 100°C” and “above freezing.” Applying this claim construction, I would find that Merritt’s disclosure of an outlet temperature of 99°C indicates that Merritt’s spray drying system included drying fluid “below 100°C.” Merritt’s drying fluid was air. Ex. 1005, 4:66. However, this example in Merritt’s disclosure was not limited to air “below 100°C” because it included air up to 187.8°C. *See* Ex. 1005, 7:24–27; Pet 31.

⁴ Dobry additionally distinguishes between a droplet with a dry skin and a dried particle. *See* Ex. 1007, Fig. 2. *Cf. Arlington Indus., Inc. v. Bridgeport Fittings, Inc.*, 345 F.3d 1318, 1330 (Fed. Cir. 2003) (prior art of record in the prosecution history is part of the intrinsic record and may be consulted in the process of claim construction for what it indicates about the state of the prior art). Dobry was cited in the original prosecution. *See* Ex. 1001, at [56] (page 3, col. 2). Dobry was also relied on by Petitioner for the knowledge of a person of ordinary skill in the art. *E.g.*, Pet. 23, 34.

Although not argued by Petitioner, I would note for completeness of discussion that overlapping ranges can, in certain circumstances, be anticipating when the claimed value does not represent a critical distinction over the prior art or when the behavior of the system remains the same throughout a range of values. *See ClearValue, Inc. v. Pearl River Polymers, Inc.*, 668 F.3d 1340, 1345 (Fed. Cir. 2012); *Atofina v. Great Lakes Chem. Corp.*, 441 F.3d 991, 999 (Fed. Cir. 2006). In this case, there is a small overlap between the claimed range (air above freezing but below 100°C) and the range in Merritt (99°C–187.8°C). However, as above, the Specification of the '388 patent explains that it addressed a problem in the prior art with air temperatures of 180°C or 200°C patent. Ex. 1001, 1:37–40, 2:28–44. Accordingly, the Specification indicates that the claimed temperature limit of 100°C is critical inasmuch as it is necessary to address the problem of higher air temperatures that cause degradation. As such, I would find that Petitioner has not established by a preponderance of the evidence that the overlapping temperature range of Merritt's spray drying system anticipates the temperature range of independent claim 1, i.e., of air below 100°C.

2. Claims 16 and 19

Claims 16 and 19 each depend, directly or indirectly, from independent claim 1. For the same reason as for independent claim 1, I would find that Petitioner has not established by a preponderance of the evidence that Merritt anticipates claims 16 and 19, i.e., that Merritt's spray drying system anticipates the temperature range of air below 100°C.

B. Obviousness over Merritt, Dobry, and Skelbæk

1. Independent claim 1

Although Petitioner has asserted a ground of obviousness based on the combination of Merritt, Dobry, and Skelbæk, Petitioner primarily relies on the same portions of Merritt asserted as anticipatory in support of its contention of obviousness. *See* Pet. 33–37. Nevertheless, Petitioner states that: “If there is any question about whether low temperature spray drying could be used in the encapsulation of active ingredients in a carrier, Skelbæk teaches the advantages of drying liquid drops under the supply of air having a temperature of 50–120°C.” Pet. 37 (citing Ex. 1008, Abstract, 2–3.).

Patent Owner argues that claim 1 is not obvious over Merritt, Dobry, and Skelbæk, for the same reason as it is not anticipated by Merritt, i.e., the temperature limitation is not met because Merritt includes gas above 100°C. In addition, Patent Owner asserts that Skelbæk may not be relied upon by Petitioner for the teaching of lower temperature because, according to Patent Owner, the product of Skelbæk’s spray drying process is wet, rather than dry. PO Resp. 46 (citing Ex. 1008, 6:20–24). In support of this argument, Patent Owner states that Skelbæk requires fluidized bed drying after spray drying in order to achieve a dried product. *Id.* Petitioner replies that “dry” powder does not require absolute dryness and that the powder resulting from the spray drying process is “dry” even if it is “subjected to further drying” in the fluidized air bed. Reply 9 (citing Ex. 1008, 7:5–10).

Petitioner is relying, in part, on the word “further” in Skelbæk’s disclosure of “further drying” in the fluidized air bed for evidence that the powder is already dry after the spray drying process of Skelbæk and before being placed in the fluidized air bed. I am unpersuaded by Petitioner’s

logic.⁵ At best, Skelbæk’s disclosure is ambiguous. Indeed, I would find that Skelbæk provides insufficient evidence as to the state of the material undergoing drying, when it discusses a process of “further drying.”

Petitioner has not adduced any persuasive evidence as to the state of the material at this time. *See In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (holding no anticipation and no obviousness) (“Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.”); *see also In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981) (concluding obviousness not proven).

The majority observes that Skelbæk discloses that the skin of a droplet is dry after the spray drying process. *Ante*, slip op. at 12, 22. However, I do not consider a wet droplet with dry skin to be dry, and Petitioner has not adduced evidence that a person of ordinary skill would so consider a wet droplet with dry skin to be dry. Skelbæk discloses that although the outer part of the matrix “solidifies” and forms a shell that is not permeable to the flavorant, the shell remains permeable to water so that water can pass through. Ex. 1008, 6:20–24. Patent Owner argues that when water can pass (diffuse) through an outer skin of a droplet, the droplet is still wet. *See* Tr. 61:15–62:22.⁶ Indeed, Figure 2 of Dobry differentiates between a “Skinned

⁵ In other words, the fact that something is subjected to a drying process and then to a further drying process does not necessarily indicate that the object was dry after the first drying process. To the contrary, it is equally likely that the fact that something is subjected to further drying may indicate that the object was only partially dry or not dry at all after the first drying process.

⁶ Patent Owner was responding at oral argument to an argument made for the first time in Petitioner’s Reply Brief, such that Patent Owner did not

Droplet” and a “Dried SDD Particle,” which supports a finding that a wet droplet with a dry skin would *not* be considered a “dried particle” nor “dried powder” to a person of ordinary skill in the art. *See* Ex. 1007, Fig. 2.

I would note that Skelbæk is only relied on by Petitioner for the understanding that it would have been obvious to try the method of Merritt with a lower temperature. Petitioner argues that it would have been obvious to try lower temperatures in order to preserve the flavorant, as taught in Skelbæk. *See* Pet. 37. Nevertheless, Petitioner has not offered persuasive evidence that there would have been a reasonable expectation of success in so doing, which is part of Petitioner’s burden. *Cf. Howmedica Osteonics Corp. v. Zimmer, Inc.*, 640 F. App’x 951, 961–62 (Fed. Cir. 2016) (application of Arrhenius equation would have led to reasonable expectation of success for a person of ordinary skill in the art in view of the “highly predictable nature of the technology”). In this connection, Patent Owner argues that Dobry does not provide a basis for experimentation because Dobry is based on near-equilibrium assumptions, does not account for kinetic limitations, and reminds that the “need for model validation cannot be understated” and that “model outputs should be validated using off-line experiments and placebo trial runs.” PO Resp. 40, 45 (citing Ex. 1006, 6, 7 n.4). I agree with Patent Owner that, in view of Dobry’s statement that the “need for model validation *cannot be understated*” (emphasis added), Dobry’s guidance does not rise to the level of a *reasonable* expectation of success.

previously have an opportunity to respond to Petitioner’s argument on this topic.

This is all the more so in view of the multiple variables required for solution in Dobry's model. Neither Petitioner, nor Petitioner's expert, rely on Dobry or provide a roadmap for a reasonable expectation of success, *e.g.*, of how it would have been obvious to use a temperature of x, and a humidity of y, with a pressure of z. There are multiple variables being manipulated at the same time, and further explanation would be required to solve for one variable with other unexplained variables in play at the same time in Dobry's equations. In this connection, Petitioner's expert has not averred that it would have been routine to a person of ordinary skill in the art to do so. As such, it is my view, that Petitioner has not satisfied its burden with respect thereto.

Therefore, I would find that Petitioner has not established by a preponderance of the evidence that the combination of Merritt, Dobry, and Skelbæk renders independent claim 1 obvious.

2. Claims 16 and 19

Claims 16 and 19 each depend, directly or indirectly, from independent claim 1. For the same reason as independent claim 1, I would find that dependent claims 16 and 19 would not have been obvious to a person of ordinary skill in the art over Merritt, Dobry, and Skelbæk, *i.e.*, Petitioner has not proven a reasonable expectation of success for lowering the temperature of air below 100°C in achieving a dry product as the result of spray drying.

C. Obviousness over Merritt, Dobry, and Watanabe

Petitioner does not rely on Watanabe for a teaching of temperature ranges. As such, Watanabe does not remedy the deficiencies in Merritt and Dobry with respect to the temperature limitation. Therefore, I would

conclude that Petitioner has not established by a preponderance of the evidence that dependent claim 28 would have been obvious to a person of ordinary skill in the art over Merritt, Dobry, and Watanabe, for the same reasons as set forth above for the asserted ground of obviousness of independent claim 1 over Merritt, Dobry, and Skelbæk. In sum, Petitioner has not shown that there would have been a reasonable expectation of success in lowering the air temperature of Merritt based on Dobry and Watanabe in drying the product.

D. Obviousness over Merritt, Dobry, Skelbæk, and Watanabe

I would conclude that dependent claims 29 and 30 would not have been obvious to a person of ordinary skill in the art over Merritt, Dobry, Skelbæk, and Watanabe, for the same reasons as set forth above for the asserted ground of obviousness of independent claim 1 over Merritt, Dobry, and Skelbæk. In sum, Petitioner has not shown that there would have been a reasonable expectation of success in lowering the air temperature of Merritt based on Dobry, Skelbæk, and Watanabe in drying the product.

E. Obviousness over DeRoos, Dobry, Skelbæk, and Tanaka

1. Independent claim 1

Applying the above claim construction, the air temperature of DeRoos is not limited to below 100°C and, despite overlapping ranges, does not meet the limitation “wherein the drying fluid comprises air at temperature that is above freezing temperature of the liquid solvent and below 100°C.”

Although DeRoos discloses outlet temperatures of 60–95°C and 70–73°C, at the same time it also discloses inlet temperatures of 130–180°C and 145–165°C. Ex. 1006, 5:65–6:15, 8:6–20. Overlapping ranges with temperatures above 100°C do not meet the temperature limitation for similar reasons as

for the grounds based on Merritt i.e., the Specification distinguishes the maintaining of temperatures below 180 or 200°C, and further below 100°C, as the cornerstone of the invention to prevent the degradation of flavorant.

Further, Patent Owner argues that DeRoos (and Skelbæk) do not form dried powder *in the drying chamber*, as recited. PO Resp. 40–41. I am persuaded by this argument. I would find that there is insufficient evidence on this record to determine whether the material leaving the spray-drying chambers of DeRoos and Skelbæk is dry without the further step of drying in the fluidized air bed. Petitioner points to a statement in DeRoos that the particles leaving the spray-drying chamber of DeRoos and entering the fluidized air bed of DeRoos are “surface dried semi-solid microparticles.” See Pet. Reply 9 (citing Ex. 1006, 4:36–40, 6:25). However, I would find that there is insufficient evidence that “semi-solid” particles with a dry skin are dry or “dried powder” for the same reason as for Skelbæk. Further, Dobry distinguishes between a wet particle with only a surface that is dry and a particle that is dry. See *supra* (discussing Ex. 1007, Fig. 2). DeRoos discloses that the semi-solid particles still have a water content of 10–20% by weight. Ex. 1006, 4:37–38. Indeed, as argued by Patent Owner, the reason DeRoos and Skelbæk subject the particles to further drying, after the spray drying chamber, in a fluidized air bed is because the particles are still wet when they emerge from the spray drying chamber of DeRoos and Skelbæk. Tr. 55:3–17.

Petitioner’s expert, Dr. Brahms, states that Dobry demonstrates that spray-drying chambers were known in the art at the time. Ex. 1010 ¶¶ 61, 62. As above, Patent Owner argues that Dobry’s computations models

cannot be relied because Dobry states that they require validation. PO Resp. 40, 45.

Neither Petitioner nor Dr. Brahms outlines what temperature would have been relied upon based on Dobry to form dried powder. To the extent that Petitioner argues that it would have been obvious to modify the spray-drying process of DeRoos and Skelbæk with the teachings of Dobry, Petitioner does not provide sufficient detail, if any, as to the nature of its proposed modification in view of Dobry. *See* Pet. 24–26. In other words, neither Petitioner nor Petitioner’s expert explain what *temperature* the system of DeRoos (or of Skelbæk) would require to form dried powder in the spray-drying unit. In the absence of detailed argument from Petitioner and in the absence of testimony from Petitioner’s declarant, Dr. Brahms, with respect to the temperature, I would conclude that there is insufficient evidence that a person of ordinary skill would form a powder to meet both the “dried powder” and the argued “temperature” limitation.⁷

I, therefore, conclude that Petitioner has not established by a preponderance of the evidence that independent claim 1 would have been obvious to a person of ordinary skill in the art over the combination of DeRoos, Dobry, Skelbæk, and Tanaka.⁸

⁷ Figure 6 of Dobry uses inlet temperatures of 65°C and 25°C. Ex. 1007, Fig. 6. However, this figure does not specify the other parameters involved, such as viscosity. Moreover, Figure 6 of Dobry uses acetone as a solvent, whereas independent claim 1 recites an aqueous solution (using water as a solvent). The identity of the solvent would be relevant to the later use of the material.

⁸ Although Petitioner does not rely on Tanaka for the any of the limitations of independent claim 1, Petitioner includes Tanaka in the combination of teachings that would render each of the claims obvious.

2. Dependent claims 16 and 19

I would conclude that Petitioner has not established that claims 16 and 19 would have been obvious to a person of ordinary skill over DeRoos, Dobry, Skelbæk, and Tanaka for the same reason as independent claim 1, from which they depend.

III. CONCLUSION

I would conclude that Petitioner has not established by a preponderance of the evidence that (1) claims 1, 16, and 19 are anticipated by Merritt; (2) claims 1, 16, and 19 are obvious over the combination of Merritt, Dobry, and Skelbæk; (3) claim 28 is obvious over the combination of Merritt, Dobry, and Watanabe; (4) claims 29 and 30 are obvious over the combination of Merritt, Dobry, Skelbæk, and Watanabe; nor (5) claims 1, 16, and 19 are obvious over the combination of DeRoos, Dobry, Skelbæk, and Tanaka.

Compare Pet. 22, with *id.* at 26. The panel instituted based on the combination of DeRoos, Dobry, Skelbæk, and Tanaka. Dec. 22, 28.

However, Petitioner does not explain how Tanaka would remedy the deficiency in the temperature or dried powder limitations.

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