

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CERAMTEC GMBH,
Petitioner,

v.

CERAMEDIC, LLC,
Patent Owner.

IPR2015-00398
Patent 6,066,584

Before GRACE KARAFFA OBERMANN, KRISTINA M. KALAN, and
JEFFREY W. ABRAHAM, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Petitioner CeramTec GmbH filed a Petition (Paper 2, “Pet.”) to institute an *inter partes* review of claims 1–5, 7–13, 15–17, 19–21, 23, 30–38, 52, and 53 of U.S. Patent No. 6,066,584 (Ex. 1001, “the ’584 patent”) pursuant to 35 U.S.C. §§ 311–319. Patent Owner CeraMedic LLC filed a Preliminary Response (Paper 7, “Prelim. Resp.”). We instituted an *inter partes* review of claims 1–5, 7–13, 15–17, 19–21, 23, 30–38, 52, and 53 on certain grounds of unpatentability alleged in the Petition (Paper 11, “Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response (Paper 20; “PO Resp.”) and Petitioner filed a Reply (Paper 22; “Reply”). An oral hearing was held on March 4, 2016. A transcript of the hearing has been entered into the record. Paper 35 (“Tr.”).

The Board has jurisdiction under 35 U.S.C. § 6(c). In this Final Written Decision, issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73, we determine that Petitioner has shown by a preponderance of the evidence that certain claims for which trial is instituted, namely, claims 1–5, 7, 11–13, 15–17, 19–21, 23, 30–38, 52, and 53, are unpatentable.

A. *Related Matters*

The parties indicate that the ’584 patent is the subject of the following district court proceeding, among others: *CeraMedic, LLC v. CeramTec GmbH*, Civil Action No. 3:14-cv-001969 (N.D. Ind.). Pet. 1; Paper 4, 1. The ’584 patent also is the subject of an *inter partes* review in IPR2015-00424. Pet. 1–2; Paper 4, 1.

B. *The ’584 Patent*

The ’584 patent, titled “Sintered Al₂O₃ Material, Process for its Production and Use of the Material,” issued on May 23, 2000. The ’584

patent describes “sintered Al_2O_3 compositions produced from corundum powder and also methods for the use of the invented compositions as medical implants or tool material.” Ex. 1001, Abstract. An initially unsintered precursor having a relative density of $\rho \cong 55\%^1$ is produced from $\alpha\text{-Al}_2\text{O}_3$ powder having defined properties using at least two different dispersing methods, and this precursor is subsequently subjected to heat treatment and sintering. *Id.* The sintered material is characterized in part “by means of a dimensionless defect density,” or “DDD,” defined as the sum of the squares of the defect sizes per area analyzed. *Id.* at 4:16–20.

C. *Illustrative Claim*

Claim 1 of the '584 patent is reproduced below:

1. A method, comprising the steps of:
 - a) dispersing $\alpha\text{-Al}_2\text{O}_3$ powder having a mean particle size d_{50} of $\leq 0.30 \mu\text{m}$ and a chemical purity of $\geq 99.9\%$ $\alpha\text{-Al}_2\text{O}_3$ in an aqueous solution to create a mixture, said mixture effected through the application of at least two different dispersing methods;
 - b) treating said mixture so as to create a shaped unsintered body having a relative density of $\rho \geq 55\%$;
 - c) heating said unsintered body; and
 - d) sintering said unsintered body so as to create a sintered material.

Ex. 1001, 15:4–14.

D. *Prior Art References Relied Upon by Petitioner*

1. Jiang Tsair Lin, *Temperature History and Microstructure of Alumina* (May 1992) (Ph.D. dissertation, University of California, Berkeley) (“Lin”) (Ex. 1002);
2. U.S. Patent No. 4,777,153 to Sonuparlak & Aksay (“Sonuparlak”) (Ex. 1003);

¹ The symbols $\cong$ and $\geq$ are used interchangeably herein.

3. Tsung-Shou Yeh, *Effect of green microstructure on the densification and microstructural evolution of alumina* (Ph.D. dissertation, University of Florida) (1989) (reproduced by University Microfilms International) (“Yeh”) (Ex. 1004);

4. Tsung-Shou Yeh & Michael D. Sacks, *Low-Temperature Sintering of Aluminum Oxide*, 71 J. AM. CERAMICS SOC. 841 (1988) (“Yeh & Sacks”) (Ex. 1005);

5. Hiroyuki Mizuta et al., *Preparation of High-Strength and Translucent Alumina by Hot Isostatic Pressing*, 75 J. AM. CERAMICS SOC. 469 (1992) (“Mizuta”) (Ex. 1006);

6. U.S. Patent No. 4,647,477 to DeLuca (“DeLuca”) (Ex. 1007);

7. D. Cannell & P. Trigg, *Processing of Electronic Ceramics*, 1 ADVANCED CERAMIC PROCESSING & TECH. 95 (Jon G.P. Binner ed., 1990) (“Cannell”) (Ex. 1008); and

8. Martin P. Jones & Gerald V. Blessing, *Real-Time Ultrasonic Nondestructive Evaluation of Green State Ceramic Powders During Compaction*, 2 NONDESTRUCTIVE TESTING COMM. 155 (1986) (“Jones”) (Ex. 1009).

E. Instituted Grounds of Unpatentability

We instituted *inter partes* review on the following grounds of unpatentability asserted in the Petition:

Reference(s)	Basis	Claim(s) Challenged
Lin	§ 102(b)	1, 4, 5, 30, 33, 34, 52, and 53
Yeh	§ 102(b)	7, 12, 13, and 37
Lin	§ 103	36
Lin and Sonuparlak	§ 103	3, 19, 20, 23, and 31
Lin and Yeh	§ 103	7, 11, 13, 32, and 37
Lin, Yeh & Sacks, and Mizuta	§ 103	35
Lin, Yeh, and Sonuparlak	§ 103	12 and 38

Lin, DeLuca, and Cannell	§ 103	15–17
Lin, Sonuparlak, and Yeh & Sacks	§ 103	21
Lin and Jones	§ 103	2
Yeh	§ 103	8–10
Yeh and Sonuparlak	§ 103	38
Yeh and Lin	§ 103	11

II. ANALYSIS

A. Claim Construction

The Board interprets claim terms in an unexpired patent according to the broadest reasonable construction in light of the specification of the patent in which they appear. *See Cuozzo Speed Techs., LLC v. Lee*, No. 15–446, 2016 WL 3369425, at *12 (U.S. June 20, 2016) (upholding the use of the broadest reasonable interpretation standard); 37 C.F.R. § 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). Only those terms which are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In our Decision on Institution, we construed “dispersing α -Al₂O₃ powder . . . in an aqueous solution to create a mixture” to mean “causing α -

Al₂O₃ powder to become or continue being distributed throughout an aqueous solution.” Dec. 5–6. We construed “dispersing methods” to mean “methods that cause α -Al₂O₃ powder to become or continue being distributed throughout an aqueous solution.” *Id.* at 6–7. We determined that the phrases “treating said mixture so as to create a shaped unsintered body” and “treating said mixture with a pressure process so as to create an unsintered precursor having a relative density of $\rho \geq 55\%$ ” needed no express construction. *Id.* at 7–8.

The parties discuss and apply these claim constructions, but neither party presents arguments or evidence persuasive to modify them in light of the record developed at trial. *See infra* Section II.B.i.c. Accordingly, we maintain our construction of the term “dispersing α -Al₂O₃ powder . . . in an aqueous solution to create a mixture” to mean “causing α -Al₂O₃ powder to become or continue being distributed throughout an aqueous solution” and “dispersing methods” to mean “methods that cause α -Al₂O₃ powder to become or continue being distributed throughout an aqueous solution.”

All other terms are accorded their ordinary and customary meaning as would have been understood by one of ordinary skill at the time of the invention. To the extent that any term requires express construction for the purposes of this decision, we discuss that construction in our analysis of the grounds of unpatentability.

B. Anticipation Arguments

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). Anticipation requires “that the reference describe not

only the elements of the claimed invention, but also that it describe those elements ‘arranged as in the claim[.]’” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (quoting *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d 1323, 1334 (Fed. Cir. 2008)).

i. Lin

Petitioner challenges claims 1, 4, 5, 30, 33, 34, 52, and 53 as anticipated under 35 U.S.C. § 102(b) by Lin. Pet. 3. Lin is a thesis directed to methods of preparing sintered Al_2O_3 material, using high-purity $\alpha\text{-Al}_2\text{O}_3$ powder with an average particle size of 0.18 μm as a starting material. Ex. 1002, 36.² Lin discloses dispersing $\alpha\text{-Al}_2\text{O}_3$ powder in water (*id.* at 36–37) and slip casting the mixture with a resulting “green compact” of about 0.61–0.63 of theoretical density (*id.* at 40). Lin also discloses treating the $\alpha\text{-Al}_2\text{O}_3$ powder mixture by a process that includes uniaxial dry pressing and cold isostatic pressing. *Id.* at 39. Lin subsequently discloses heating the green compact (*id.* at 40–41), and sintering the unsintered bodies to create a sintered material (*id.* at 42, 108).

Petitioner argues that Lin discloses every element of claims 1, 4, 5, 30, 33, 34, 52, and 53. Pet. 14–18, 20–21, 27–28, 46–49. Regarding the dispersing step, Petitioner argues that Lin discloses that the $\alpha\text{-Al}_2\text{O}_3$ powder was dispersed in water “to create a mixture by applying two dispersing methods as follows: (i) ‘ $\alpha\text{-Al}_2\text{O}_3$ powder was dispersed in deionized water,’ which resulted in a ‘dilute dispersed aqueous suspension’ (Lin at 36–37); (ii) after this initial dispersing, ‘[a]n ultrasonic probe was applied to the Al_2O_3 suspension’ (*Id.* at 37).” Pet. 15. Regarding claim 52, which requires

² Our citations to page numbers of the non-patent literature prior art generally follow Petitioner’s pagination.

“treating said mixture with a pressure process so as to create an unsintered precursor having a relative density of $\rho \geq 55\%$,” Petitioner argues that Lin’s disclosure of uniaxial dry pressing and cold isostatic pressing meets this limitation. *Id.* at 47–48 (pointing out that claim 53, which depends from claim 52, implicitly defines the “pressure process”).

(a) Two different dispersing methods

Patent Owner argues that Lin does not expressly disclose at least two different dispersing methods, as required by claim 1. PO Resp. 4. Patent Owner characterizes Petitioner’s allegations as an inherency argument regarding the two different dispersing methods: “(i) an unnamed purported dispersing method that led to the ‘dilute dispersed aqueous suspension of 2 vol% solid concentration,’ which Petitioner claims cannot be ultrasonication; and (ii) the application of an ultrasonic probe ‘to the Al_2O_3 suspension for about 10 minutes to break down the soft agglomerates.’” *Id.* (citing Pet. 15–16; Ex. 1002, 36–37). Patent Owner argues that Lin does not inherently and unavoidably disclose “two *different* dispersing methods,” citing the example given by its expert that Lin could ultrasonicate twice. *Id.* at 5–6 (citing Ex. 2008 ¶ 68).

Petitioner responds that Lin “*expressly* discloses two different dispersing methods: a first method that it does not name and a second one that it does (ultrasound).” Reply 2; Tr. 19:9–12. Petitioner argues that it “strains credulity to suggest that Lin ultrasonicated once to initially disperse the powder and then again at a higher power, but only disclosed the second ultrasonication step.” Reply 2 (citing Ex. 1020 ¶ 9). Petitioner’s expert opines that in order for ultrasonication to be able to disperse powder

particles, “the particles need to already be wetted and incorporated into the liquid.” Ex. 1020 ¶ 9.

It is not disputed that the cited portion of Lin discloses two dispersing steps that occur at discrete points in time. It is disputed whether these two discrete dispersing steps are different dispersing steps. The second dispersing method involves application of an ultrasonic probe to the Al_2O_3 suspension. Ex. 1002, 36–37. At that point, an Al_2O_3 suspension is already created. Although Lin’s first dispersing method is not named, it requires that “ Al_2O_3 powder was dispersed in deionized water” such that a “dilute dispersed aqueous suspension of 2 vol% solid concentration was prepared.” *Id.* at 37. Thus, in Lin’s first dispersing method, Al_2O_3 powder is introduced to liquid to create a dilute dispersed aqueous solution. Our construction of dispersing method encompasses “methods that cause $\alpha\text{-Al}_2\text{O}_3$ powder to become or continue being distributed throughout an aqueous solution.” Certain Examples of the ’584 patent provide that the powders “were introduced” as part of the first dispersing step. Ex. 1001, 11:39–40, 12:63, 14:3. Introducing dry powder to liquid is a method that causes the powder to become distributed throughout an aqueous solution. This is a dispersing method that is different than ultrasonication. Even if powder were introduced to liquid, and ultrasonicated at the same time, this still is a “different” dispersing method than ultrasonication alone by virtue of the introduction to liquid step. Thus, Lin discloses two different dispersing methods.

(b) Third dispersing method

In the alternative, Petitioner, in its Reply arguments concerning anticipation by Lin, refers to a third dispersing method disclosed in Lin.

Reply 3. Petitioner originally presented this third dispersing method in support of its claim 32 arguments based on obviousness over Lin and Yeh, rather than its claim 1 arguments based on anticipation by Lin. Pet. 24–25. There, Petitioner argued that Lin provides that “the suspension was ‘stirred continuously’ while being ‘flash dried under an infrared lamp.’” *Id.* (citing Ex. 1002, 37). Petitioner now argues that Lin’s stirring step may be a third dispersing method that causes α -Al₂O₃ powder to become or continue being distributed throughout an aqueous solution. Reply 3. Regarding the stirring disclosed in Lin, Petitioner states that “it is a third dispersing method and claim 32 is dependent on claim 1. So if you were to find that claim 32 was invalid, then you would have to consider whether the independent claim was also invalid for the same reasons.” Tr. 21:4–8.

Patent Owner argues that “Lin discloses different types of experiments, one slip casting, one is uniaxial dry pressing,” and that Petitioner relied on the slip casting embodiment for anticipation by Lin. Tr. 28:25–29:4. Patent Owner argues that the stirring, i.e., the third dispersing method, referenced by Petitioner is in the context of the uniaxial dry pressing embodiment, which is a different embodiment than the slip casting embodiment. *Id.* at 29:10–14. Petitioner responds that its expert testimony supports that, in the slip casting embodiment, Lin “would have also dried and stirred to get to the 40 percent solution that is slip cast.” Tr. 73:3–8, 74:2–4 (quoting Ex. 1020 ¶ 10).

We note the statutory requirement that the initial Petition should identify “with particularity” the “evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3). A petition must include “[a] full statement of the reasons for the relief requested, including a detailed

explanation of the significance of the evidence including material facts, and the governing law, rules, and precedent.” 37 C.F.R. § 42.22(a)(2).

Moreover, “[a] reply may only respond to arguments raised in the corresponding . . . patent owner response.” *Id.* § 42.23(b). “While replies can help crystalize issues for decision, a reply that raises a new issue or belatedly presents evidence will not be considered and may be returned.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012).

We weigh our application of these statutes and rules with the principle that the “development of evidence in the course of the trial is in keeping with the oppositional nature of an *inter partes* review proceeding.” *Genzyme Therapeutic Prods. v. Biomarin Pharm.*, Nos. 2016-1720, 2015-1721, 2016 WL 3254734, at *4 (Fed. Cir. June 14, 2016). The critical question for compliance with the APA and due process is whether a party received “adequate notice of the issues that would be considered, and ultimately resolved, at that hearing.” *Id.* at *5. We are persuaded that the Petition’s claim 32 arguments, in which Yeh was combined with Lin for an obviousness argument, adequately put Patent Owner on notice of Petitioner’s arguments that Lin’s third dispersing method—stirring—could be another dispersing method in Petitioner’s anticipation argument for claim 1 based on Lin. Here, Lin is the only prior art upon which Petitioner bases its anticipation argument, and Lin identifies a third dispersing method in close textual proximity to the identification of the first two dispersing methods. Ex. 1002, 37 (listing stirring on the same page, in the same paragraph, and only four lines after discussing ultrasonication). Patent Owner was made aware of this third dispersing method in Petitioner’s case-in-chief, albeit regarding a different claim. Under the

particular circumstances presented here, we are persuaded that the disclosure in Lin, relating to the stirring step, was fairly raised in the Petition and that Patent Owner was given a fair opportunity to address its import in this proceeding.

We acknowledge Patent Owner's argument that it was unable to respond fully to Petitioner's argument. Tr. 28:15–16. However, Patent Owner was able to cross-examine Petitioner's expert on this issue, and submitted its Motion for Observations on Cross-Examination. Paper 29. Patent Owner could have, but did not, request a sur-reply to brief this issue; Patent Owner also did not file a motion to exclude portions of Petitioner's expert testimony. *See Genzyme*, 2016 WL 325734, at *6; *see also Belden, Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1081 (Fed. Cir. 2015) (identifying options for Patent Owner faced with new evidence in Reply). Based on the arguments before us and the evidence cited therein, we agree that Petitioner has provided adequate explanation and evidence to support its contention that Lin discloses stirring as a third dispersing method.

(c) Intensive dispersing methods

Patent Owner also argues that, based on the record developed after institution, Lin does not even disclose two “dispersing methods.” PO Resp. 7. According to Patent Owner and its expert, “dispersing methods” refers to “intensive dispersing techniques, of which mechanical stirring, ball milling, and ultrasonication are examples identified in the '584 Patent.” *Id.* (citing Lilley Dec. ¶¶ 62–67). Consistent with its position that “dispersing methods” means “intensive dispersing techniques,” Patent Owner argues that Lin discloses only one dispersing method: ultrasonication. *Id.* at 8.

Petitioner responds that whatever Lin did to create its dispersed aqueous suspension must have involved causing the alumina powder to

become distributed throughout the solution, in line with the Board's construction. Reply 1–2. Petitioner argues that nothing in the record supports that Patent Owner's proffered interpretation is the broadest reasonable construction of the phrase. *Id.* at 2.

We agree with Petitioner and retain our original claim construction concerning dispersing methods. Patent Owner's urged interpretation would require us to import examples from the Specification into the claim, which we decline to do. *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004); *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). Patent Owner's argument that “dispersing” must mean “intensive dispersing” is not supported by the evidence of record.

(d) Claims 52 and 53

Regarding claims 52 and 53, Patent Owner argues that “Lin's uniaxial dry pressing embodiment does not disclose ‘treating said mixture with a pressure process so as to *create* an unsintered precursor having a relative density of $\rho \geq 55\%$ ’” as recited in Claim 52.” PO Resp. 10. According to Patent Owner, “Lin's uniaxial dry pressing *creates* a shaped specimen with a density of only 0.53 of theoretical density, for a relative density less than 55%.” *Id.* Petitioner's reliance on the 0.60 ± 0.01 relative density for the post-cold-isostatic-pressing green compacts in Lin, according to Patent Owner, is flawed in that cold isostatic pressing in Lin is not part of Lin's “treating said mixture with a pressure process so as to create an unsintered precursor.” *Id.* at 10–11. Patent Owner avers that “cold isostatic pressing takes place after any purported ‘treating’ step in Lin.” *Id.* at 11.

Petitioner responds that neither the claim language of claim 52 nor the Specification supports Petitioner's interpretation effectively limiting step (b)

to processes with only one compaction step. Reply 4 (noting that several Examples in the Specification use two compaction steps). Rather, Petitioner argues, a “pressure process that increases the relative density of a compact from below 55% to above 55% ‘creates’ an unsintered precursor with $\geq 55\%$ relative density, even if another compaction step is performed first.” *Id.*

We are not persuaded that the cold isostatic pressing takes place outside of or after the treating step in Lin. We agree with Petitioner’s analysis regarding the claims being flexible enough to allow for creation of an unsintered precursor using more than a single compaction step, thereby obtaining the required relative density of $\rho \geq 55\%$.

As noted by both parties, claims 52 and 53 also require “two different dispersing steps.” Our analysis regarding this limitation in claim 1 applies equally to this limitation in claims 52 and 53 as well as dependent claims 4, 5, 30, 33, and 34. Patent Owner limits its arguments regarding dependent claims 4, 5, 30, 33, and 34 to those already discussed above for claim 1. Our review of the Petition and the evidence presented in support of Petitioner’s challenge to claims 4, 5, 30, 33, and 34 persuades us that Lin anticipates those claims.

We have reviewed the arguments presented in the Petition and the supporting evidence regarding the anticipation of the remaining elements of claims 1, 4, 5, 30, 33, 34, 52, and 53 that were not disputed by Patent Owner in its Response. Pet. 14–18, 20–21, 27–28, 46–49. In the Scheduling Order, we cautioned Patent Owner that any arguments for patentability not raised in the Response would be deemed waived. Paper 12, 3. After reviewing the arguments and evidence presented concerning the remaining claim elements of claims 1, 4, 5, 30, 33, 34, 52, and 53 (see Pet. 14–18, 20–21, 27–28, 46–

49, discussing the remaining claim elements of these claims), we find a preponderance of the evidence establishes that Lin expressly discloses the remaining elements of claims 1, 4, 5, 30, 33, 34, 52, and 53.

In sum, we are persuaded by Petitioner's argument that Lin anticipates claim 1, its challenged dependent claims 4, 5, 30, 33, and 34, and claims 52 and 53.

ii. Yeh

Petitioner challenges claims 7, 12, 13, and 37 as anticipated under 35 U.S.C. § 102(b) by Yeh. Pet. 5. Yeh is a thesis that discloses methods of preparing sintered Al_2O_3 material, using commercially-available, high-purity (>99.99%) alumina powders. Ex. 1004, 69. The "intermediate size distribution" ("ISD") powder disclosed in Yeh has a median particle size (d_{50}) of 0.39 μm . *Id.* at 293–296. Yeh discusses at least three different methods of creating a mixture of ISD powder in aqueous solution: stirring (*id.* at 72), ultrasonication (*id.* at 76), and mixing (*id.*). Yeh also discloses slip casting the mixture, resulting in a green compact having a relative density of 70%. *Id.* at 316. The green compact of Yeh is air-dried and further dried by heating (*id.* at 76) and sintered in air to create a sintered material (*id.* at 78).

Petitioner argues that Yeh discloses every element of claims 7, 12, 13, and 37. Pet. 33–36, 39–40, 43–45. Regarding the particle size distribution of Yeh's ISD powder, Petitioner relies on the Clarke Declaration to argue that the geometric standard deviation for the ISD powder is 1.7, and thus the d_{84} value is well above 0.45 μm , and the d_{16} value is necessarily greater than 0.065 μm . Pet. 35 (citing Ex. 1013 ¶¶ 56–57; Ex. 1004, 294, Fig. 5.1). With respect to the dispersing step of claim 7 and the dispersing methods

applied in series of claim 37, Petitioner argues that Yeh discloses at least three different dispersing methods, applied in series: first stirring, then ultrasonication, then mixing. *Id.* at 35–36, 45. Petitioner argues that Yeh discloses the treating, heating, and sintering steps of claim 7 as well. *Id.* at 39–40.

Patent Owner argues that Yeh does not disclose all of the limitations of claim 7 as arranged in the claim, either expressly or inherently. PO Resp. 12–17. Patent Owner argues that “as Claim 7 is arranged, the shaped unsintered body must achieve a relative density of $\rho \geq 55\%$ in the “treating” step before undergoing the “heating” step.” *Id.* at 13.

(a) Preliminary heating step

Petitioner replies that both the claim language and Specification of the '584 patent show that step (b) of claim 7 can include a heating step distinct from the heating step of step (c). Reply 6. In every Example of the '584 patent, Petitioner argues, “the step (b) process of making a shaped unsintered body having a relative density of at least 55% includes a preliminary heating step.” *Id.* In Example 1 of the '584 patent, and other Examples, there is a preliminary heating step referred to as “drying”: “[a]fter drying at 80° C., the relative density achieved was 61.0% of the theoretical density.” Ex. 1001, 9:65–67. In Example 1, and other Examples, the drying step after which density is measured is followed by “preliminary firing” at 800°C, and subsequent pressureless sintering in air at 1400°C. *Id.* at 10:1–5. We agree with Petitioner that the Examples in the Specification, together with the “comprising” language of the claim 7 preamble, allow for a drying step or preliminary heating step before the relative density measurement is determined.

(b) Order of steps

Regarding the order of steps, however, Patent Owner argues that Petitioner does not demonstrate that Yeh meets the limitations of claim 7 as they are arranged in claim 7, which provides that “treating said mixture so as to create a shaped unsintered body having a relative density of $\rho \geq 55\%$ ” occurs before “heating said unsintered body.” PO Resp. 13. Patent Owner argues that the order of steps is critical. Tr. 30:10–12.

Interactive Gift Express, Inc. v. Compuserve Inc., 256 F.3d 1323, 1342–43 (Fed. Cir. 2001) recites a two-part test for determining if the steps of a method claim that do not otherwise recite an order, must nonetheless be performed in the order in which they are written. First, we look to the claim language to determine if, as a matter of logic or grammar, they must be performed in the order written. *Id.* If not, we next look to the rest of the specification to determine whether it “directly or implicitly requires such a narrow construction.” *Id.* at 1343. If not, the sequence in which such steps are written is not a requirement. *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1369–70 (Fed. Cir. 2003). In the present situation, the claim language indicates that the steps must be performed in the order written in order to achieve the claimed result. Performing the dispersing step after the treating step, for example, would be illogical and very likely impossible. The Specification also indicates that the method is stepwise, in that each step physically alters the characteristics of the material on which it is performed. Thus, the sequence in which the steps are taken is a requirement in this case. As discussed below, this sequence of steps is critical to our analysis of whether Yeh discloses the treating and heating steps of claim 7.

(c) Mercury porosimetry and Archimedes displacement

Patent Owner explains that Yeh's measurement of relative density of the slip cast bodies was done by (a) mercury porosimetry, which was done after the slip cast bodies "spent 24 hours in an oven at 90°C and very likely also underwent calcining," (PO Resp. 13) and (b) Archimedes displacement, which was done after placing the slip cast bodies "in an oven for 24 hours at 90°C *and* calcining them at 700°C for 30 minutes." *Id.* at 14. The green density of the slip cast ISD samples measured by these methods was about 70% relative density. Ex. 1004, 316, 427. "By relying on a post-oven, post-calcining relative density in Yeh," argues Patent Owner, "Petitioner improperly combines the "treating" and "heating" steps, ignoring the arrangement of Claim 7's limitations." *Id.* at 14–15.

Regarding mercury porosimetry, Petitioner replies that "Yeh does not disclose that the green compacts were calcined before the mercury porosimetry measurements" that gave a relative density of about 70% for the green compacts. Reply 7. Regarding Archimedes displacement, Petitioner agrees that Yeh discloses calcining before the Archimedes displacement relative density measurement. *Id.* In view of Yeh's mercury porosimetry measurements in which calcining was not performed, argues Petitioner, Yeh achieved the relative density required. *Id.* at 8. Patent Owner's expert Dr. Lilley opines that Yeh would have "*very likely* also calcined the cast body before measuring its relative density by mercury porosimetry." Ex. 2008 ¶¶ 76, 80 (emphasis added). Petitioner's expert Dr. Clarke opines that it is not necessary to calcine before mercury porosimetry. Ex. 1020 ¶ 13.

We agree that there is nothing in Yeh indicating that calcining occurred before measurement of relative density by mercury porosimetry.

Given the lack of an explicit statement in Yeh regarding calcining in connection with mercury porosimetry, and the nondispositive testimony of the experts on this issue, we decline to read a calcining step into the mercury porosimetry measurement of Yeh when the evidence does not support that a person of ordinary would have understood such a step to be present.

Patent Owner also argues that Petitioner changed its position on its anticipation by Yeh arguments. Tr. 44:16–17. The parties do not appear to dispute that Yeh discloses the at least two different dispersing methods of step (a) of claim 7. Pet. 34–36; PO Resp. 12–17. The parties also do not appear to dispute that Yeh discloses the sintering step (d) of claim 7. Pet. 40; PO Resp. 12–17.

The dispute, therefore, centers on the order of treating step (b) and heating step (c) of claim 7. Petitioner initially stated that claim 7's treating step (b) was met by Yeh's treatment to create unsintered "green compacts" by slip casting, wherein the "relative density of the unsintered bodies was 70%." Pet. 39 (citing Ex. 1004, 76, 316, Table 5.2). Petitioner initially stated that claim 7's heating step (c) was met by Yeh's disclosure "that the unsintered bodies made by slip casting of the ISD powder mixture were dried by heating. Yeh at 76. The unsintered bodies were also calcined by heating to 700°C to 'remove moisture and volatile species.' Yeh at 78." Pet. 40.

Yeh itself discloses that its slip-cast green compacts were "air dried for about 8 h" and then "the compacts were removed from the tubes and further dried in an oven at 90°C for 24 h." Ex. 1004, 76. Dr. Clarke testified that the oven drying of Yeh falls within part of step (b) of claim 7. Paper 29,

7 (citing Ex. 2013, 62:5–20). Thus, we look to the evidence before us to determine where in Yeh a heating step (c) could occur.

Yeh provides, “[t]he porosity and pore size distribution of the green compacts were characterized by mercury porosimetry” (Ex. 1004, 77) and “[t]he porosity characteristics of the powder compacts was also determined by the Archimedes method.” *Id.*

The mercury porosimetry route does not clearly involve a calcining step before measurement of density, as discussed above. The parties also have not directed us to any portion of Yeh indicating that mercury porosimetry route involves a calcining step after measurement of density. Dr. Clarke agreed that “there’s no calcining that takes place whatsoever for the samples in Yeh that were measured using mercury porosimetry[.]” Paper 29, 8 (citing Ex. 2013, 26:20–24). Patent Owner indicates that Petitioner’s expert stated that the samples tested by mercury porosimetry “would not be sintered because you couldn’t get the mercury out of the pores. So that group wouldn’t satisfy the sintering step.” Tr. 45:6–8.

The Archimedes displacement route, however, does involve a calcining step, which takes place before density measurement. Ex. 1004, 78. Dr. Clarke testifies that Yeh’s statement “All green compacts were calcined . . . to remove moisture and volatile species and to obtain sufficient strength for boiling in water” refers to relative density measurements by Archimedes displacement, because mercury porosimetry measurements “do not involve boiling in water, so it would not be necessary to calcine before taking those measurements.” Ex. 1020 ¶ 15 (citing Ex. 1004, 77–78). Dr. Clarke also agreed that “the calcining process described in Yeh, that would fall within part of Step (b) of Claim 7.” Paper 29, 8–9 (citing Ex. 2013,

64:4–8). Density measurement in the Archimedes displacement method, therefore, does not take place until after calcining.

The steps in Yeh that could constitute heating step (c) of claim 7 are oven drying and calcining. In Yeh, both of these take place before the relative density measurement occurs. A density measurement of 55% percent is required at the end of treating step (b) of claim 7. Yeh discloses no density measurement until after its heating step (c). We have determined that the order of steps is critical in this case. Thus, Yeh does not disclose, in the proper order, a treating step creating a shaped unsintered body having a relative density measurement of $\rho \geq 55\%$, followed by a heating step.

(d) Inherency

Petitioner argues that Yeh inherently discloses that the unsintered body had a relative density of $\geq 55\%$ even before calcining. Reply 9. More specifically, Petitioner argues that because the relative density of the unsintered ISD compacts was 70%, calcining would have had to increase the relative density of the oven-dried compacts more than 15% in order for the pre-calcining density to have been less than 55%, which is not possible. *Id.* at 10 (citing Ex. 1020 ¶ 18–20); Tr. 25:20–26:2. Petitioner argues that this argument was not waived, and is responsive to Patent Owner’s inherency arguments. Reply 9 n.3.

As Patent Owner notes, Petitioner presents no evidence and no calculations to support its assertion. Tr. 50:19–21, 51:15–16. According to Patent Owner, Petitioner’s expert says heating affects density, but does not say by how much, and Patent Owner’s expert says there is no evidence that there must have been a 55% relative density before the heating step. *Id.* at 51:16–22. Probabilities or possibilities are not enough to establish inherent

disclosure. *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981). The standard of inherency is that the putative inherent disclosure must be the “necessary and only reasonable construction to be given the disclosure.” *Kennecott v. Kyocera Int’l, Inc.*, 835 F.2d 1419, 1423 (Fed. Cir. 1987). Dr. Clarke’s testimony, although it addresses this matter, extrapolates its conclusion from Yeh’s measurements of the relative density of a green compact prepared from a different starting powder. Ex. 1020 ¶ 18–20. Dr. Clarke testified that he did not perform or supervise any tests following Yeh’s procedure to determine the effect of calcining on relative density. Paper 29, 10–11 (citing Ex. 2013, 67:22–68:15, 69:16–19). We are not persuaded that Dr. Clarke’s testimony in this regard is well supported by underlying facts and data. See *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) (“[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations.”); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 294 (Fed. Cir. 1985) (“Lack of factual support for expert opinion going to factual determinations . . . may render the testimony of little probative value in a validity determination.”). Accordingly, we are unpersuaded that Petitioner’s arguments and the evidence presented in support thereof establish that Petitioner’s interpretation is the necessary and only reasonable one to be given to Yeh.

Claims 12, 13, and 37 all depend from claim 7 and incorporate its limitations. Patent Owner limits its arguments regarding dependent claims 12, 13, and 37 to the grounds already discussed above for claim 7, and Petitioner’s replies are similarly tailored. Our analysis of the arguments

above regarding the limitations of claim 7 persuades us that Yeh also fails to anticipate claims 12, 13, and 37.

For the reasons articulated above, and after consideration of the foregoing arguments, we are unpersuaded by Petitioner's arguments that Yeh anticipates claims 7, 12, 13, and 37.

C. Obviousness Arguments

In resolving the question of the obviousness of the claims, we consider the following underlying factual determinations: (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) secondary considerations of nonobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Petitioner bears the burden of establishing obviousness of the challenged claims by a preponderance of the evidence. 35 U.S.C. § 316(e).

i. Lin

Petitioner challenges the following claims as obvious under 35 U.S.C. § 103(a), based on Lin:

- (Ground 2) claim 36 over Lin;
- (Ground 3) claims 3, 19, 20, 23, and 31 over Lin and Sonuparlak;
- (Ground 4) claims 7, 11, 13, 32, and 37 over Lin and Yeh;
- (Ground 5) claim 35 over Lin, Yeh & Sacks, and Mizuta;
- (Ground 8) claims 12 and 38 over Lin, Yeh, and Sonuparlak;
- (Ground 10) claims 15–17 over Lin, DeLuca, and Cannell;
- (Ground 11) claim 21 over Lin, Sonuparlak, and Yeh & Sacks; and
- (Ground 12) claim 2 over Lin and Jones.

(a)(Ground 2) Claim 36 over Lin

Petitioner argues that Lin’s disclosure of a uniaxial dry pressing step, followed by a cold isostatic pressing step, followed by a heating step, meets the limitations of claim 36. Pet. 31–32 (citing Ex. 1002, 37, 39). Petitioner argues that although the “treating” step in Lin results in a green compact with only a 53% relative density, as opposed to the 55% required by the claims, “[i]t was well known in the art that green density was a result-effective variable.” *Id.* at 32–33 (citing Ex. 1013 ¶¶ 82–85).

Patent Owner argues that, because claim 36 incorporates all of the limitations of claim 1, Lin does not teach, suggest, or disclose at least two different dispersing methods. PO Resp. 19. Petitioner, in reply, references its anticipation arguments relating to Lin. Reply 10. We have discussed, *supra*, that Lin discloses two different dispersing methods under an anticipation standard. That analysis informs our determination here. *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983).

Regarding another limitation of claim 1, Patent Owner argues that Petitioner’s argument that “Lin suggests the limitation ‘treating said mixture so as to create a shaped unsintered body having a relative density of $\rho \geq 55\%$ ’” is based on impermissible hindsight. PO Resp. 19. Patent Owner questions, if it were obvious to increase the relative density of a shaped unsintered body, and if it were obvious to increase the relative density by routine experimentation with uniaxial dry pressing, “why did Lin employ an *entirely separate cold isostatic pressing process to increase relative density?*” *Id.* at 20. Petitioner replies that this argument makes no sense, because “Lin used cold isostatic pressing to achieve a 60% relative density, which does not mean that the uniaxial dry pressing step could not have been

optimized to achieve 55%.” Reply 13. We agree, in that use of a second process to further increase relative density does not diminish the ability of a person of ordinary skill in the art to increase the relative density during a first process, to optimize a result-effective variable. *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980).

Petitioner notes that “Patent Owner does not dispute that a person of ordinary skill in the art could have achieved a relative density of 55% by increasing the pressure of uniaxial dry pressing.” Reply 11. Relying on the declaration of Dr. Clarke and the Richerson³ reference cited therein, Petitioner argues that increasing pressure increases relative density in a uniaxial dry pressing step by at least the 2% needed to get from the 53% in Lin to the $\geq 55\%$ required by the claims. *Id.* (citing Ex. 1020 ¶¶ 21–23). We note that, contrary to Patent Owner’s argument that Petitioner is precluded from relying on Richerson (PO Resp. 20 n.4), art “can legitimately serve to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness.” *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015). We credit Dr. Clarke’s testimony that Richerson refers to uniaxial dry pressing, for the reasons given in his declaration. Ex. 1020 ¶¶ 21–23. Because Lin only used 50 MPa of pressure in its uniaxial dry pressing step to achieve 53% relative density, and because it was known in the art to use from 70 MPa to 140 MPa of pressure in a similar process to increase relative density to greater than 55%, we agree that it “would have been straightforward and well within the capabilities of a person of ordinary skill

³ David W. Richerson, MODERN CERAMIC ENGINEERING 418–518 (ch. 10) (1992) (“Richerson”) (Ex. 1010).

in the art to increase the pressure used.” *Id.* ¶ 24. Routine optimization of a result-effective variable, such as the density of the green compact by uniaxial dry pressing, would have led a person of ordinary skill to a relative density greater than 55%. *In re Boesch*, 617 F.2d at 276.

Petitioner argues that adding binders and plasticizers was another well-known way of increasing the relative density of the uniaxially dry pressed body in Lin. Pet. 33 (citing Ex. 1012 ¶ 84), Reply 12–13 (citing Ex. 1020 ¶¶ 25–28). Petitioner responds to Patent Owner’s claim that Lin was already using binders, and would not further use binders (PO Resp. 21–22), by pointing out that the section of Lin to which Patent Owner refers is in the background and refers to spray-dried granules, which were not used in Lin. Reply 12. We are persuaded by and adopt Petitioner’s reasoning (as articulated in Pet. 31–33 and Reply 10–13) on this matter.

(b) (Ground 3) Claims 3, 19, 20, 23, and 31 over Lin and Sonuparlak

Sonuparlak teaches methods of preparing sintered Al₂O₃ materials; Sonuparlak’s initial powder suspension is “continuously stirred and ultrasonicated when required to break-up agglomerates of particles.” Ex. 1003, 10:47–49. Petitioner argues that “Sonuparlak teaches methods of making Al₂O₃ ceramic materials that are similar to the methods taught in Lin: a suspension of α - Al₂O₃ powder in water is formed, the suspension is used [to] make an unsintered compact by slip casting, and the compact is heated and then sintered.” Pet. 18 (citing Ex. 1003, 4:26–39, 10:41–11:8). Regarding reasons to combine, Petitioner’s expert opines that substituting the ultrasonication in Lin with simultaneous stirring and ultrasonication in Sonuparlak “would have required nothing more than substituting one known

element with another known element to yield predictable results.” *Id.* at 19 (citing Ex. 1013 ¶¶ 42–44.)

Patent Owner argues that “Lin and Sonuparlak have completely opposite goals: non-porous, fully dense ceramics in Lin as opposed to porous ceramics in Sonuparlak.” PO Resp. 23. Patent Owner argues, thus, that Lin and Sonuparlak teach away from one another. *Id.* Patent Owner also argues that the proposed combination would render Lin unsatisfactory for its intended purpose of producing a well-dispersed Al_2O_3 suspension for use in forming fully dense ceramics, because Lin operates at pH 3–4, whereas Sonuparlak operates at a pH kept above 9. *Id.* at 23–25.

A reference teaches away from a claimed invention if it “criticize[s], discredit[s], or otherwise discourage[s]” modifying the reference to arrive at the claimed invention. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). We will not, however, “read into a reference a teaching away from a process where no such language exists.” *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1364 (Fed. Cir. 2006).

Although Sonuparlak and Lin are directed to making different types of ceramics, they both still concern the making of ceramics. Regarding dispersing methods, both teach that Al_2O_3 powder must be dispersed in water, and Al_2O_3 agglomerates must be broken down. We do not find that Sonuparlak’s teaching of making a more porous ceramic criticizes, discredits, or otherwise discourages modifying the dispersing methods of Lin.

A reference also teaches away when the proposed modification renders the prior art unsatisfactory for its intended purpose. *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984) (finding no suggestion to modify a prior

art device where the modification would render the device inoperable for its intended purpose). For the reasons given by Petitioner, we do not agree that the proposed modification, namely, incorporating Sonuparlak's simultaneous stirring and ultrasonication into Lin, would render Lin unsatisfactory for its intended purpose. Patent Owner has failed to direct us to sufficient evidence of record to suggest that the pH in Sonuparlak relative to the pH in Lin is germane to the proposed modification at hand. For example, Lin states only that a pH of 3–4 is optimal, not required. Ex. 1002, 36–37.

Sonuparlak discloses that the “suspension was continuously stirred and ultrasonicated when required.” Ex. 1003, 10:47–49. Patent Owner takes the position that this phrase “does not *necessarily* indicate that stirring and ultrasonication occurred simultaneously with stirring; only that ultrasonication was applied when required.” PO Resp. 26. Petitioner argues that “Sonuparlak’s disclosure of *continuous* stirring and ultrasonication would be understood by a person of ordinary skill in the art as disclosing that stirring *continued* while ultrasonication was applied.” Reply 15 (citing Ex. 1020 ¶ 29). On balance, we are persuaded by Petitioner’s argument. If stirring were required to stop in order to ultrasonicate the suspension, then the stirring would not be continuous as specified by Sonuparlak. *Id.*

We are persuaded by Petitioner’s showing that the combination of Lin and Sonuparlak would have been within the level of ordinary skill in the art, and would include dispersing the Al₂O₃ powder by stirring and ultrasound (Claim 3; Pet. 18–19), simultaneous stirring and ultrasound (Claims 19, 20, 23; Pet. 55–57), and two different dispersing methods applied simultaneously (Claim 31; Pet. 21).

(c) (Ground 4) Claims 7, 11, 13, 32, and 37 over Lin and Yeh

Petitioner argues that, although “Lin does not disclose dispersing a powder with the d_{16} , d_{50} , and d_{84} values required by claim [7(a)],” this deficiency is overcome by Yeh. Pet. 36. Petitioner further argues that “using the ISD slip preparation method taught by Yeh in the methods of Lin would have yielded acceptable and predictable results,” and also that “using a dried form of [Yeh’s] ISD powder in the methods of Lin would have yielded acceptable and predictable results.” *Id.* at 38 (citing Ex. 1013, 70–71). Petitioner’s arguments for claims 11, 13, and 37 are variations on this argument. Regarding claim 32, Petitioner argues that Lin discloses that its hard-agglomerate-free powder meets the limitations of claim 32, but does not disclose dispersing the hard-agglomerate-free powder using two dispersing methods. *Id.* at 24. Petitioner relies on Yeh to cure this deficiency, stating that it would have been “obvious to modify Lin to apply the further dispersing steps of ultrasonication and mixing taught by Yeh to the hard-agglomerate-free powder suspension to prepare the suspension for slip casting.” *Id.* at 24–25 (citing Ex. 1013 ¶¶ 58–62).

Regarding claims 7, 11, 13, and 37, which impose requirements on the particle size distributions of α - Al_2O_3 , Patent Owner relies on Lin’s statement that “a starting material of very high purity with submicron size and *narrow size distribution is essential*.” PO Resp. 28 (citing Ex. 1002, 36). Patent Owner argues that Lin’s “prepared hard-agglomerate-free powder had a ‘very narrow’ size distribution with a d_{50} average particle size of 0.17 μm and a geometric standard deviation of 1.6.” *Id.* (footnote omitted). Conversely, “Yeh’s ISD powder, by contrast, had a d_{50} particle size of 0.39 μm and a geometric standard deviation of 1.7.” *Id.* at 29. Thus, given Lin’s

statement that “narrow size distribution is essential,” Patent Owner argues that one of ordinary skill in the art would not have replaced Lin’s powder with Yeh’s coarser “intermediate size distribution powder.” *Id.* at 29–30.

Petitioner replies that Yeh’s powder meets all three criteria that are “essential” according to Lin: very high purity, submicron size, and narrow distribution. Reply 16. Petitioner disagrees that Patent Owner’s calculation of Lin and Yeh’s relative size spread is relevant to comparing the breadth of particle size distributions. *Id.* at 17 (citing Ex. 1020 ¶¶ 37–38). All told, Petitioner argues that despite the “substantial difference in the $d_{15.9}$ to $d_{84.1}$ spread value,” both powders still have a “very narrow” distribution based on geometric standard deviation, which is 1.6 in Lin and 1.7 in Yeh. *Id.* (noting that Lin and Yeh both relied on geometric standard deviation when discussing particle size distributions).

Lin’s criteria of very high purity, submicron size, and narrow distribution (Ex. 1002, 36) are not so restrictive as to exclude the powder disclosed by Yeh, even though Yeh’s ISD powder may be somewhat coarser and have a somewhat broader particle size distribution than the powder actually used in Lin. Lin’s general criteria allow one of ordinary skill in the art to determine an appropriate powder based on those criteria. *Id.* at 37. We are persuaded by Petitioner’s evidence that an ordinarily skilled artisan would have found Yeh’s powder suitable in view of the criteria set forth in Lin.

Regarding claim 32, which depends from claim 1, Patent Owner argues that Petitioner’s attempt to meet the required particle size distribution by subjecting the prepared hard-agglomerate-free powder of Lin to purported additional dispersing methods of Yeh is unavailing. PO Resp. 30–

31. Patent Owner argues that the person of ordinary skill in the art would not have added unnecessary process steps on a powder or suspension already substantially ready for use. *Id.* at 32.

Petitioner replies that a person of ordinary skill in the art would have recognized the benefit of the proposed modification and the benefit of the additional steps disclosed by Yeh in the process of Lin. Reply 18–19 (citing Ex. 1020 ¶¶ 41–45). Petitioner notes that Patent Owner agrees that Lin discloses stirring the hard-agglomerate-free powder suspension. *Id.* at 18. Because Yeh’s green density, at 70%, was higher than Lin’s green density, at 61%, Petitioner argues that one of ordinary skill in the art would have been motivated to incorporate at least one of Yeh’s two additional dispersing methods into the method of Lin. *Id.* at 19 (citing Ex. 1020 ¶¶ 43–45).

We are persuaded by Petitioner’s reasoning that adding the dispersing steps of Yeh to the dispersing step or steps of Lin would be advantageous to the dispersing process. One of ordinary skill in the art, understanding that Yeh has a higher green density, would have looked to Yeh’s dispersing methods to improve the dispersing process of Lin. Patent Owner, as noted by Petitioner, did not address the benefits of good dispersion and mixture aging pointed out in the Petition. Reply 19 (citing Pet. 25). Thus, one of ordinary skill in the art would have been motivated to combine one or more of Yeh’s methods with Lin’s method.

(d) (Ground 5) Claim 35 over Lin, Yeh & Sacks, and Mizuta

Petitioner states that Lin does not disclose using pressure filtration to create the shaped unsintered body, but that Yeh & Sacks, which teaches making Al₂O₃ materials by methods similar to Lin’s, discloses pressure filtration. Pet. 29–30 (citing Ex. 1005, 1, 3). Petitioner further argues that

Mizuta, which also teaches making Al_2O_3 materials by methods similar to Lin's, discloses pressure filtration applying a pressure of 0.3 MPa. *Id.* at 30 (citing Ex. 1006, 1). Petitioner contends that it would have been obvious to use the pressure filtration of Yeh & Sacks in place of Lin's slip casting, and to apply 0.3 MPa of pressure to accelerate consolidation as taught by Mizuta. *Id.* at 30 (citing Ex. 1012 ¶¶ 77–81).

Patent Owner argues that the combination of Lin with Yeh & Sacks would render them unsuitable for their intended purposes of producing a well-dispersed Al_2O_3 at an acidic pH. PO Resp. 33. Because Lin operates at pH 3–4, and because Yeh & Sacks suggests preparation of suspensions at pH ≈ 4 , Mizuta, which operates at a pH of 9.2, would render Lin and Yeh & Sacks unsuitable for their intended purposes, according to Patent Owner. *Id.* at 34–35.

Petitioner replies that Patent Owner has not identified any teachings that would have discouraged the use of pressure filtration at 0.3 MPa in Lin's method, and that one of ordinary skill in the art would not have been dissuaded from using Mizuta's techniques. Reply 20–21 (citing Ex. 1020 ¶ 46).

As discussed above, a reference teaches away when the proposed modification renders the prior art unsatisfactory for its intended purpose. *Gordon*, 733 F.2d at 902. For the reasons given by Petitioner, we do not agree that the proposed modification, namely, incorporating Mizuta's particular pressure into the pressure filtration system of the Lin and Yeh & Sacks combination, would render Lin or Lin and Yeh & Sacks unsatisfactory for their intended purposes of using pressure filtration to create the shaped unsintered body. When discussing pressure and pressure filtration, the pH in

Mizuta relative to the pH in Lin or Yeh & Sacks does not appear germane to the proposed modification at hand.

Patent Owner also argues that, because claim 35 incorporates all of the limitations of claim 1, Lin does not teach, suggest, or disclose at least two different dispersing methods. PO Resp. 19. We have addressed this argument in Section II.B.i, *supra*.

(e) (Ground 8) Claims 12 and 38 over Lin, Yeh, and Sonuparlak

Petitioner argues that the Lin method, as modified by substituting “a dried form of the ISD powder taught by Yeh” for the as-received commercial powder taught by Lin and “as further modified by using simultaneous stirring and ultrasound as taught by Sonuparlak” meets the limitations of claims 12 and 38, and that the claims would, therefore, have been obvious. Pet. 44, 46.

Patent Owner argues, as before in Ground 3, that Lin and Sonuparlak teach away from each other, and the combination would render Lin unsuitable for its intended purpose. PO Resp. 36. Patent Owner also argues that Sonuparlak, which operates at a pH of 9 or 10.6, and Yeh, which operates at a pH of 4, would render each other unsuitable for their respective intended purposes. *Id.* at 37.

Petitioner replies that Patent Owner’s arguments against the combination of Lin, Yeh and Sonuparlak suffer from the same deficiencies as Patent Owner’s arguments against the combination of Lin and Sonuparlak (Ground 3) and Lin and Yeh (Ground 4). Reply 21.

Again, a reference teaches away when the proposed modification renders the prior art unsatisfactory for its intended purpose. *Gordon*, 733 F.2d at 902. For the reasons given by Petitioner, we do not agree that the

proposed modification, namely, incorporating Sonuparlak's simultaneous stirring and ultrasonication into Lin or Yeh, would render Lin or Yeh unsatisfactory for their intended purposes. The pH in Sonuparlak relative to the pH in Lin or Yeh does not appear germane to the proposed modification at hand.

(f) (Ground 10) Claims 15–17 over Lin, DeLuca, and Cannell

Petitioner states that Lin does not disclose dispersing the α -Al₂O₃ powder by stirring and subsequently milling, but that DeLuca teaches creating an alumina mixture using a magnetic stirrer, and Cannell teaches methods of making ceramic products that involve preparing mixtures of powder raw material using milling. Pet. 52–55 (citing Ex. 1007, 11:43–54; Ex. 1008, 8–10). Petitioner contends that it would have been “obvious to use stirring, as taught by DeLuca, and milling, as taught by Cannell, in the place of dispersing and ultrasound,” as a matter of substituting known methods of doing the same thing to achieve predictable results. *Id.* at 53–54.

Patent Owner argues, first, that combining Lin and DeLuca would render Lin unsuitable for its intended purpose, because Lin prepares its suspension at pH 3–4, while DeLuca prepares its suspension in a basic, sodium hydroxide solution. PO Resp. 39. Patent Owner argues, second, that Cannell teaches away from the subject matter of claims 15–17, in that its process “should contain as few steps as possible.” *Id.* at 40 (citing Ex. 1008, 4–5). Patent Owner argues, third, that DeLuca is non-analogous art, as it relates to coating alumina ceramic substrates for manufacturing printed circuit boards. *Id.* at 41.

Petitioner replies, first, that Patent Owner has not identified any teachings that would have discouraged the use of stirring and milling in

Lin's method, and that one of ordinary skill in the art would not have been dissuaded from making this modification. Reply 21 (citing Ex. 1020 ¶ 47). For the reasons given by Petitioner, we do not agree with Patent Owner's position that the proposed modification, namely, incorporating DeLuca's stirring into the method of Lin, would render Lin unsatisfactory for its intended purpose of creating an effectively dispersed suspension.

Petitioner replies, second, that the proposed modification is to incorporate stirring and milling into Lin's method, which is a two-for-two substitution and would not increase the number of steps. Reply 22. We do not find that Cannell discredits, discourages, or criticizes making such a substitution. *In re Fulton*, 391 F.3d at 1201.

Petitioner replies, third, that DeLuca is analogous art that is reasonably pertinent to the particular problem with which the inventor is involved. Reply 22. We are persuaded that DeLuca, which addresses avoiding agglomeration of alumina particles in an aqueous suspension, is reasonably pertinent to the problem at hand, namely, avoiding agglomeration of alumina particles in an aqueous suspension. *Id.* (citing Ex. 1001, 6:52–55, 7:2–7).

(g) (Ground 11) Claim 21 over Lin, Sonuparlak, and Yeh & Sacks

Petitioner's arguments for claim 21, wherein the treating step of step (b) comprises pressure filtration, are based on the same reasons as Petitioner's arguments for claim 35. Pet. 57. Patent Owner similarly argues that for at least the same reasons given in connection with Ground 3, a person of ordinary skill in the art would not have combined Lin and Sonuparlak, Yeh & Sacks and Sonuparlak, or all three together. PO Resp. 42–43. Petitioner replies that Patent Owner's argument against this

combination has the same deficiencies as Patent Owner's Ground 3 arguments. Reply 22.

For generally the same reasons given above for claim 35 and in connection with Ground 3, we are persuaded by Petitioner's arguments regarding the combination of Lin, Sonuparlak, and Yeh & Sacks.

(h) (Ground 12) Claim 2 over Lin and Jones

Petitioner states that Lin does not disclose that the aqueous solution comprises polyvinyl alcohol (PVA) and glycerol to create a mixture, as required by claim 2, but that Jones teaches a method of creating shaped unsintered bodies that starts with dispersing Al_2O_3 powder in an aqueous solution that contains PVA and glycerol. Pet. 50 (citing Ex. 1009, 3). Petitioner contends that it was known in the art that binders and plasticizers like PVA and glycerol, respectively, aid in the pressing process and increase the strength of unsintered bodies. *Id.* (citing Ex. 1013 ¶ 95). Petitioner further contends that it would have been obvious to modify Lin to include PVA and glycerol as taught by Jones "in order to achieve better density and strength of the powder compact." *Id.* at 51 (citing Ex. 1013 ¶¶ 92–95).

Patent Owner argues that Lin's purported "treating" step creates a compact with only a relative density of 53%, rather than the 55% required by the claims. PO Resp. 45. Patent Owner further argues that cold isostatic pressing, which takes place after uniaxial dry pressing, is not part of the "treating" step. *Id.* at 45–46.

Petitioner relies on its arguments for claims 52 and 53 regarding the cold isostatic pressing step being part of the "treating" step of Lin, and on its arguments for Ground 2 regarding the use of binders in Lin. Reply 23.

For largely the same reasons set forth above in connection with claims 52 and 53 and Ground 2, we are persuaded by Petitioner's reasoning articulated in Ground 12 for combining Lin and Jones.

ii. Yeh

Petitioner challenges the following claims as obvious under 35 U.S.C. § 103(a), based on Yeh:

(Ground 7) claims 8–10 over Yeh;

(Ground 9) claim 38 over Yeh and Sonuparlak; and

(Ground 13) claim 11 over Yeh and Lin.

(a)(Ground 7) Claims 8–10 over Yeh

Petitioner argues that it would have been obvious, based on the teachings of Yeh, to use a pH between 3 and 7 in the powder mixture used for slip casting. Pet. 41. “Yeh teaches that powder mixtures with pH values below about 7 are sufficiently well-dispersed to allow formation of powder compacts with high relative density (>65%),” which Petitioner argues would have suggested to a person of ordinary skill in the art that using a pH of below about 7 would have contributed to good dispersion and formation of high quality powder compacts. *Id.* (citing Ex. 1004, 35–36, Figure 2.1(C); Ex. 1013 ¶ 87).

(b)(Ground 9) Claim 38 over Yeh and Sonuparlak

Petitioner argues that Yeh does not disclose applying two dispersing methods simultaneously, but that Sonuparlak does, relying on Petitioner's earlier arguments for claims 3 and 31 regarding the combination of Lin and Sonuparlak. Pet. 46.

(c) (Ground 13) Claim 11 over Yeh and Lin

Petitioner argues that it would have been obvious to modify Yeh, which does not expressly disclose adding any of the substances recited in claim 11 to the powder mixture, with the teachings of Lin to include MgO in the powder mixture. Pet. 42–43. Petitioner argues that Yeh would have prompted one to make this modification, in that Yeh teaches that MgO has a beneficial effect of “enhancing densification kinetics and producing fully dense alumina.” *Id.* at 43 (citing Ex. 1004, 19; Ex. 1013 ¶¶ 89–91).

Patent Owner argues that “Claims 8–10 depend from Claim 7, so Petitioner did not establish that those claims are obvious over Yeh, either.” PO Resp. 47. Patent Owner makes similar arguments for claim 38 (*id.* at 48) and claim 11 (*id.* at 49–50). Petitioner, in its Reply, relies on its Ground 6 anticipation arguments for Yeh to rebut Patent Owner’s arguments on these grounds. Reply 23–24.

(d) Analysis

A conclusion of obviousness requires at least a suggestion of all the limitations in a claim by the prior art. *CFMT, Inc. v. Yieldup Int’l Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) (citation omitted). We have determined that claim 7 is not anticipated by Yeh, and Petitioner provides no further argument from which we can reasonably conclude that the subject matter of claim 7 would have been obvious over Yeh. Section II.B.ii., *supra*. On this record, therefore, we agree with Patent Owner that Petitioner has failed to carry its burden of establishing the obviousness of the subject matter of claims 8–10, which inherit all the limitations of claim 7.

Petitioner has not presented separate obviousness arguments or expert testimony regarding the challenge to claim 7 based on Yeh. As such, any

Graham factor analysis we would perform on Petitioner's evidence would be hampered by a lack of Petitioner argument clearly directed to such a standard. We also lack countervailing obviousness arguments or evidence from Patent Owner, who would not have been on notice that it would have to respond to Petitioner's anticipation arguments as though they were obviousness arguments.

Even if we were to view Petitioner's anticipation arguments and evidence through a lens of obviousness, though, we would be unpersuaded that Yeh renders obvious claim 7, largely for the same reasons given above in our analysis above regarding anticipation of claim 7 by Yeh. The steps of claim 7 must be performed in a particular order, and Petitioner's presentation of evidence has not persuaded us that it would have been obvious to vary the steps of Yeh to meet the limitations of claim 7. Petitioner also presented no evidence and no calculations to support its assertion that it would have been inherent, or obvious, that the unsintered body have a relative density of $\geq 55\%$ before calcining. As discussed *supra*, Dr. Clarke's testimony extrapolated its conclusion from Yeh's measurements of the relative density of a green compact prepared from a different starting powder, and failed to include tests of Yeh's procedure to determine the effect of calcining on relative density. Ex. 1020 ¶ 18–20; Paper 29, 10 (citing Ex. 2013, 67:22–68:15). We are not persuaded that Dr. Clarke's testimony in this regard is well supported by underlying facts and data, and we are unpersuaded that his testimony would support a finding of obviousness for claim 7.

Our review of Petitioner's arguments regarding obviousness of claims 8–11 and 38 involving Yeh as a references requires reference to Petitioner's

anticipation analysis of base claim 7. We are not persuaded that Yeh anticipates claim 7. We are not persuaded that we should consider Petitioner's Yeh anticipation arguments as though they were obviousness arguments; even if we did, we are not persuaded that Petitioner would meet its burden of showing that claim 7 is obvious over Yeh alone. Thus, we are unpersuaded that any of the challenged claims that depend from claim 7 would be unpatentable on these obviousness grounds based on Yeh. After review of the full record, we are unpersuaded by Petitioner's obviousness arguments based on Yeh with respect to claims 8–11 and 38.

iii. Secondary Considerations

Patent Owner argues that secondary considerations compel a conclusion of nonobviousness as to each of the instituted § 103 grounds. PO Resp. 50–58. We, therefore, consider this evidence along with the contentions of the parties in reaching our final determination as to the obviousness of the challenged claims.

Objective indicia of nonobviousness may include any of the following: long-felt but unsolved need, failure of others, unexpected results, commercial success, copying, licensing, and praise. *Graham*, 383 U.S. at 17; *see also Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349–1355 (Fed. Cir. 2012). Patent Owner argues that copying of the claimed invention and unexpected results attributable to the claimed invention should be considered. PO Resp. 51.

All types of objective evidence of nonobviousness must be shown to have a nexus between the evidence and the claimed invention. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). The stronger the showing of

nexus, the greater the weight accorded the objective evidence of nonobviousness. *See Ashland Oil, Inc.*, 776 F.2d at 306.

(a) Copying

Patent Owner asserts that “[i]ndisputable evidence of copying exists.” PO Resp. 51. Patent Owner points to U.S. Patent No. 8,485,042 (Ex. 2009, “the ’042 patent”), which pertains to manufacturing sintered alumina “elastic deformation bodies,” arguing that the claims of the ’042 patent substantially mirror the challenged claims of the ’584 patent. *Id.* at 52–54 (citing Ex. 2009). Patent Owner argues that the nexus “is self-evident” in that the owners of the ’042 patent “literally copied or paraphrased both the individual limitations and the combinations of the limitations of the ’584 Patent’s challenged claims into the claims of the ’042 Patent.” *Id.* at 54.

Petitioner replies that Patent Owner has not established copying, in that Patent Owner has not presented evidence that certain limitations of independent claims 1, 7, 15, 19, and 52 were copied. Reply 24. Petitioner also argues that there is no evidence that any actual product on the market or method in commercial use was copied from the claimed invention. *Id.*

Copying, as objective evidence of nonobviousness, requires evidence of effort to replicate a specific product, which may be demonstrated through “internal company documents, direct evidence such as disassembling a patented prototype, photographing its features, and using the photograph as a blueprint to build a replica, or access to the patented product combined with substantial similarity to the patented product.” *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010); *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004). Like other types of objective evidence, evidence of copying must be shown to have a nexus to

the claimed invention. *Wm. Wrigley Jr. Co. v. Cadbury Adams USA LLC*, 683 F.3d 1356, 1364 (Fed. Cir. 2012).

The testimony presented by Patent Owner in support of its copying contention is insufficient to support a finding that the mirroring of language in the '042 patent constitutes an effort to replicate a specific product or method. *See, e.g.*, Ex. 2008 ¶¶ 205–207 (asserting that the claims in the '042 patent copy or paraphrase the claims of the '584 patent). The allegation that the claims in the '042 patent are similar to those in the '584 patent fails to show that those claims were practiced in any way that would constitute copying of the actual methods or resulting materials covered by the challenged claims. Patent Owner has directed us to no legal authority supporting its argument that copying of claim language is sufficient to establish copying in the context of secondary considerations. Therefore, arguments that the alleged copying involves the language of the claims, rather than the product covered by the claims, fail to establish the nexus required to support an allegation of copying.

(b) Unexpected Results

Patent Owner argues that the claimed subject matter of the '584 patent achieved at least two unexpected results. PO Resp. 54. First, Patent Owner argues, the '584 patent teaches that “it was extraordinarily surprising that sintered products having . . . a Vickers low-load hardness of ≥ 1750 and a flexural strength of ≥ 800 MPa could be specified and obtained by producing microstructures having a mean grain size of ≤ 1.5 μm or ≤ 2.0 μm and a relative sintered density of $\rho \geq 98.5\%$.” *Id.* at 55 (citing Ex. 1001, 9:9–16; Ex. 2008 ¶¶ 209–14). Second, Patent Owner argues, the '584 patent “also achieved unexpectedly superior mechanical properties via pressureless

sintering in air.” *Id.* at 56. Patent Owner argues that “*all* of the challenged claims, which each depend from one of Claims 1, 2, 7, 15, 19, or 52, incorporate a ‘sintering’ step. That ‘sintering’ step encompasses ‘pressureless sintering in air.’” *Id.* at 57.

Petitioner replies that Patent Owner has not established unexpected results, in that Patent Owner does not establish a nexus to the challenged claims, which do not have any limitations regarding properties of ceramic materials. Reply 24–25. Petitioner also argues that the prior art (specifically Igarashi⁴) disclosed “a material with hardness of 1900, strength of 1066 MPa, mean grain size below 2 μ m, and relative density of 99.7%” in 1991, values that are “as good as or better than those Patent Owner alleges were surprising.” *Id.* at 25. Finally, regarding pressureless sintering in air, Petitioner argues that Patent Owner has failed to establish a nexus to the claims, because none of the challenged claims exclude hot isostatic pressing or recite a hardness limitation. *Id.*

As our reviewing court has explained, “any superior property must be *unexpected* to be considered as evidence of non-obviousness.” *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1371 (Fed. Cir. 2007). All types of objective evidence of nonobviousness must be shown to have nexus. *In re Kao*, 639 F.3d 1057, 1069 (Fed. Cir. 2011). The claims of the subject patent must be shown to be commensurate in scope with the asserted showing of unexpected results advanced by Patent Owner. *See In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983); *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“the applicant’s showing of unexpected results must be

⁴ Certified Translation of Japanese Patent Application Pub. No. JP 1990255563, published October 16, 1990 (“Igarashi”) (Ex. 1017).

commensurate in scope with the claimed range”); *In re Clemens*, 622 F.2d 1029, 1035 (CCPA 1980) (“In order to establish unexpected results for a claimed invention, objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.”).

Regarding hardness and grain size, Dr. Lilley states that improved hardness at grain sizes below 3–4 μm was unexpected at the time of the ’584 patent. Ex. 2008 ¶ 209. Dr. Clarke, however, states that the properties disclosed by Igarashi, which are as good as or better than those Patent Owner identifies in its patent, would not be surprising to a person of ordinary skill in the art. Ex. 1020 ¶ 56. Patent Owner also directs us to the Specification’s statements regarding extraordinary surprise and unexpectedly superior properties; we find, however, that those statements are subjective. PO Resp. 55–56. Weighing the evidence presented, we are not persuaded, based on the evidence of record, that the improved hardness, strength, grain size, and relative density were unexpected.

Regarding pressureless sintering in air, we agree with Petitioner that no nexus has been demonstrated by Patent Owner: the challenged claims are all method claims with no limitations drawn to the mechanical properties of the finished product. Even considering Patent Owner’s arguments directed to pressureless sintering in air, we note that Dr. Clarke opines that Igarashi includes a pressureless sintering in air step. Ex. 1020 ¶ 57. Because Igarashi attains a hardness superior to that disclosed by the ’584 patent via pressureless sintering in air, we are not persuaded by Patent Owner’s argument that the mechanical properties of its product are unexpected. Dependent claims 5, 13, 17, and 23, which recite the limitation “wherein

said sintering comprises pressureless sintering in air,” do not exclude the possibility of other steps. Accordingly, as none of the challenged claims exclude hot isostatic pressing or recite a hardness limitation, the evidence of unexpected results made of record does not demonstrate a nexus between the alleged unexpected results and the challenged claims.

On the current record, Patent Owner has not established that the challenged claims of the '584 patent are commensurate in scope with the asserted showing of unexpected results advanced by Patent Owner. We are persuaded by Petitioner's argument that Patent Owner failed to show unexpected results. Reply 24–25. Accordingly, we do not find that the proffered evidence of unexpected results supports Patent Owner's argument of nonobviousness.

D. Testimony of Dr. Clarke

Patent Owner argues that the Board should not credit Dr. Clarke's testimony, because Petitioner's counsel did not properly instruct him on several key points of the law of obviousness. PO Resp. 58.

Regarding the testimony of Dr. Clarke, we can accord appropriate weight to an expert's testimony, taking into account the expert's understanding of the level of skill in the art at the time of the invention. *See, e.g., Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010) (holding the Board has discretion to give more weight to one item of evidence over another “unless no reasonable trier of fact could have done so”); *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d at 1368. We are not persuaded that Dr. Clarke's testimony should be given no weight due to Petitioner's counsel's alleged failure to instruct him on the law of obviousness. We accord the

appropriate weight to Dr. Clarke's testimony as indicated in this Decision and for the reasons articulated in this Decision.

E. Conclusion

For the foregoing reasons, after considering the Petition, Patent Owner Response, Reply, and the evidence relied upon by Petitioner and Patent Owner, including evidence of anticipation, obviousness, and secondary considerations, we are persuaded that Petitioner has shown by a preponderance of the evidence that claims 1–5, 7, 11–13, 15–17, 19–21, 23, 30–38, 52, and 53, are unpatentable. Petitioner has not shown, by a preponderance of the evidence, that claims 8–10 are unpatentable.

III. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–5, 7, 11–13, 15–17, 19–21, 23, 30–38, 52, and 53, are held unpatentable; and

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

IPR2015-00398
Patent 6,066,584

FOR PETITIONER:

Gina N. Shishima
Thomas Owens
Mark T. Garrett
FULBRIGHT & JAWORSKI L.L.P.
gina.shishima@nortonrosefulbright.com
tom.owens@nortonrosefulbright.com
mark.garrett@nortonrosefulbright.com

FOR PATENT OWNER:

Kevin K. McNish
John M. Desmarais
Andrew G. Heinz
DESMARAIS LLP
kmcnish@desmaraisllp.com
jdesmarais@desmaraisllp.com
aheinz@desmaraisllp.com