

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GC CORPORATION AND GC AMERICA, INC.,
Petitioner,

v.

ARDENT, INC.,
Patent Owner.

IPR2018-00941
Patent 6,455,451 B1

Before JEFFREY B. ROBERTSON, CHRISTOPHER L. CRUMBLEY, and
WESLEY B. DERRICK, *Administrative Patent Judges*.

DERRICK, *Administrative Patent Judge*.

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

I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, Petitioner has shown by a preponderance of the evidence that claims 1–4 and 57–61 of U.S. Patent No. 6,455,451 B1 are unpatentable.

A. Procedural History

Petitioner, GC Corporation and GC America, Inc., collectively, filed a Petition requesting an *inter partes* review of claims 1–4 and 57–61 of U.S. Patent No. 6,455,451 B2 (“the ’451 patent”). Paper 1 (“Pet.”). Patent Owner, Ardent, Inc., declined to file a Patent Owner Preliminary Response. On November 8, 2018, upon consideration of the Petition, applying the standard set forth in 35 U.S.C. § 314(a), we instituted an *inter partes* review of all challenged claims on all grounds asserted. Paper 6 (“Inst’n Dec.”).

In the Scheduling Order, which sets times for taking action in this proceeding, we cautioned Patent Owner that “any arguments for patentability not raised in the [Patent Owner] response may be deemed waived.” Paper 7, 5. Patent Owner, however, did not file a Patent Owner Response. Paper 8, 2. Further, neither party requested oral argument. *Id.*

We authorized the parties to file a joint paper (“the Status Report”) “providing the Board with the current status of any related District Court and ITC proceedings, . . . specify[ing], . . . any ITC determination bearing on the validity of [any] claim.” *Id.* On September 18, 2019, the Parties filed a joint paper, as authorized, with certain papers from US ITC Investigation 337-TA-1050. Paper 9 (Status Report); Exs. 1013–1016. As set forth in the Status Report, “[t]he only related District Court proceeding—*Ivoclar*

Vivadent AG v. GC America Inc., No. 1:17-cv-02083 (N.D. Ill.)—was dismissed without prejudice on January 8, 2019.” Status Report, 1. Also as set forth in the Status Report, and supporting exhibits, “[n]either the [ITC’s Initial Determination (ID)] nor the Commission’s Opinion directly addresses the ’451 patent claims because all of the asserted claims of the ’451 patent were terminated from the ITC Investigation prior to the issuance of the ID.” Status Report, 2; Ex. 1013, 2; Ex. 1014, 2; Ex. 1015, 1–2; Ex. 1016, 2–3. The Status Report states, however, that “[a]s this IPR proceeding asserts grounds of unpatentability based upon prior art references that were analyzed in the ID (Petticrew and Beall), the ITC’s determinations regarding those references may be relevant to the Board in its analysis of the patentability of claims 1–4 and 57–61 of the ’451 patent.” Status Report, 2 (citing Ex. 1015, 13; Ex. 1016, 84–92).

We have before us, therefore, the Petition with no Patent Owner Response and, to the extent applicable, papers from, or referencing, an ITC proceeding that do not include any determination directly addressing any claim of the ’451 patent. Nonetheless, Petitioner bears the burden to show, by a preponderance of the evidence, that the challenged claims are unpatentable.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–4 and 57–61 of the ’451 patent are unpatentable.

B. Related Proceedings

As indicated above, the ’451 patent was—but is no longer—the subject of litigation in both *Ivoclar Vivadent AG v. GC America Inc.*, No. 1:17-cv-02083 (N.D. Ill.) and *In the Matter of Certain Dental Ceramics*,

Products Thereof, and Methods of Making the Same, Inv. No. 337-TA-1050 (USITC). Status Report, 1–2; Inst’n Dec. 2; Paper 3, 2.

A patent identified by the Parties as related, U.S. Patent No. 6,802,894 (“the ’894 patent”), is the subject of a concurrent *inter partes* review proceeding—IPR2018-00940. Inst’n Dec. 3; Paper 3, 2. The ’894 patent was also the subject of litigation in the ITC proceeding, Investigation No. 337-TA-1050, but, unlike the ’451 patent, asserted claims of the ’894 patent were maintained in the proceeding through to the termination of the investigation. IPR2018-00940, Paper 7, 3; Ex. 1013, 2; Ex. 1014, 1–3; Ex. 1015, 1–4; Ex. 1016, 6, 41–96.

C. The ’451 Patent

The ’451 patent is titled “Pressable Lithium Disilicate Glass Ceramics,” and is directed to lithium disilicate based glass-ceramics useful in fabricating dental restorations made by heat pressing into refractory investment molds. Ex. 1002, Abstract.

D. Illustrative Claims

Petitioner challenges claims 1–4 and 57–61. Independent claims 1 and 3 are directed to glass-ceramic compositions. Independent claims 57 and 61 are directed to dental restorations. Claims 1, 3, and 57 include the transitional phrase “consisting essentially of” and, thus, limit the recited composition to a greater degree than claim 61, which includes the transitional phrase “comprising.” *PPG Indus. v. Guardian Indus. Corp.*, 156 F.3d 1351, 1354 (Fed. Cir. 1998) (“A ‘consisting essentially of’ claim occupies the middle ground between closed claims that are written in a ‘consisting of’ format and fully open claims that are drafted in a ‘comprising’ format.”). The term “consisting essentially of” “signals that

the invention necessarily includes the listed ingredients and is open to unlisted ingredients that do not materially affect the basic and novel properties of the invention.” *Id.*

Claims 1, 3, 57, and 61 are reproduced in relevant part¹ below.

1. A glass-ceramic composition consisting essentially of in weight percent:

about 64 to about 70% SiO₂;
about 1.5 to about 6[%] Al₂O₃;
about 10 to about 15% Li₂O;
about 2.5 to about 5% K₂O;
about 2 to about 7% P₂O₅;

....

3. A glass-ceramic composition consisting essentially of in weight percent:

about 64 to about 70% SiO₂;
about 5.2 to about 9[%] Al₂O₃;
about 10 to about 15% Li₂O;
about 2 to about 7% P₂O₅;

...

up to about 5% K₂O;

...

up to about 0.9% CaO;

...

up to about 3% ZrO₂;

....

57. A dental restoration comprising a glass-ceramic consisting essentially of:

¹ The claims allow for the optional inclusion of additional components in amounts “up to” a certain endpoint. We omit the recitation of these optional components unless relevant to the asserted grounds of unpatentability.

about 62 to about 85% SiO₂;
about 1.5 to about 10% Al₂O₃;
about 8 to about 19% Li₂O;
about 2.5 to about 7% K₂O;
about 0.5 to about 12% P₂O₅;

....

61. A dental restoration comprising the glass-ceramic composition comprising:

about 64 to about 70% SiO₂;
about 5.2 to about 9[%] Al₂O₃;
about 10 to about 15% Li₂O; and
about 2 to about 7% P₂O₅.

Ex. 1002, 11:48–12:41, 18:40–19:16.

Claims 2 and 4, depending from claims 1 and 3, respectively, recite that “the glass-ceramic is pressable.” *Id.* at 12:9–10, 40–41. Claim 58, depending from claim 57, recites a list of particular components into which the dental restoration of claim 57 is formed. *Id.* at 19:1–6. Claim 59 recites “[a] blank for machining the dental restoration of claim 57.” *Id.* at 19:7–8. Claim 60 recites “[a] dental restoration comprising the glass-ceramic of claim 1.” *Id.* at 19:9–10.

E. Cited Art

Petitioner relies on the following references:

Beall et al., United States Patent No. 5,219,799, issued June 15, 1993 (“Beall”) (Ex. 1004);

Petticrew, International Publication No. WO 95/32678, published December 7, 1995 (“Petticrew”) (Ex. 1003); and

L. M. Echeverria, *New Lithium Disilicate-Glass Ceramics*, BOL. DE LA SOC. ESP. DE CERAMICA, 183–188, 1992 (“Echeverria”) (Ex. 1005).

The earliest priority date claimed for the ’451 patent is December 11, 1998, based on U.S. Provisional Application No. 60/111,872. Ex. 1002, code (60). The patent publications, Beall and Petticrew, issued or were published, respectively, more than one year prior to this earliest claimed priority date. Ex. 1002, code (60), 1:6–10; Ex. 1003, code (43); Ex. 1004, code (45). Echeverria is identified by Petitioner and Petitioner’s declarant Dr. Clark as an article published in 1992 that is prior art to the ’451 patent under 35 U.S.C. § 102(b) (pre-AIA). Pet. 14; Ex. 1001 ¶ 54. We need not, however, reach whether Petitioner has established Echeverria as a printed publication within the meaning of 35 U.S.C. § 311(b) that is prior art to the ’451 patent because, as set forth below, the grounds based on Beall and Petticrew are dispositive as to all the challenged claims.

F. Asserted Grounds of Unpatentability

Petitioner challenges claims 1–4 and 57–61 on the following grounds of unpatentability. Pet. 13, 22–56.

Claims Challenged	35 U.S.C. §	References
1, 3	103	Beall
2, 4, 57–61	103	Petticrew and Beall
3	103	Echeverria
4, 57–59, 61	103	Petticrew and Echeverria

In support of its contentions, Petitioner relies on the declaration testimony of Dr. Arthur E. Clark (Ex. 1001). Dr. Clark is a technical declarant retained for this proceeding. Ex. 1001 ¶ 10.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner contends that a person of ordinary skill in the art at the time of the invention

would have had knowledge and experience relating to the design, production and use of glass-ceramic compositions for various applications would have been able to design compositions for specific products, taking into account such variables as desired mechanical properties and the application for which the glass-ceramic composition is being used [and] would have had a bachelor's or advanced degree, such as an M.S. or Ph.D. in chemistry, physics, ceramics, materials science and engineering, or chemical engineering, coupled with 2-5 years of academic or industry experience in the area of glass-ceramic research and development or similar work.

Pet. 20–21 (citing Ex. 1001 ¶¶ 31–33).

Absent opposition from Patent Owner, we accept and adopt Petitioner's description of the level of ordinary skill in the art because it is consistent with the level of skill reflected in the asserted prior art references. In that regard, the prior art itself is sufficient to demonstrate the level of skill in the art at the time of the invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

B. *Claim Construction*

In an *inter partes* review based on a petition filed prior to November 13, 2018, the Board interprets claim terms in an unexpired patent according

to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2017).² Under that standard, we interpret claim terms using “the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant’s specification.” *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). Only those terms which are in controversy need to be construed and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *see also U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997) (holding claim construction is not necessary when it is not “directed to, or has been shown reasonably to affect, the determination of obviousness”).

Petitioner offers express constructions for: (1) “consisting essentially of”; (2) “dental restoration”; (3) “pressable”; (4) “blank”; and (5) “about.” Pet. 14–18. The phrase “consisting essentially of” is contended to be open to further components, including those identified in the claims. *Id.* at 15; Ex. 1002, 11:56–12:8, 12:17–39, 18:48–67. The phrase “dental restoration” is contended to mean “a dental appliance shaped for placement into a patient’s mouth.” Pet. 16 (citing Ex. 1001 ¶¶ 36–37; Ex. 1002, Abstract).

² A recent amendment to this rule does not apply here because the Petition was filed prior to November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)).

Petitioner further relies on the '451 patent as identifying dental restorations as including different dental appliances, including bridges, crowns, tooth replacement appliances, and dentures. *Id.* at 16–17 (citing Ex. 1002, 2:36–44, 3:17–18, 5:62–65). The term “pressable” is contended to mean “able to be formed into dental articles by heat pressing or injection molding using commercially available equipment.” *Id.* at 17 (citing Ex. 1001 ¶¶ 38–39; Ex. 1002, 2:44–48). The term “blank” is contended to mean “a small piece of material in a form (such as a cylinder or rectangular block) suitable for further processing into a dental restoration.” *Id.* (citing Ex. 1001 ¶ 40; Ex. 1002, 3:4–9, 3:17–18). The term “about” is contended to mean “approximately.” *Id.* (citing Ex. 1001 ¶ 41). Petitioner also contends that “about” should “be further construed as ± 2 units in the least significant figure position” (*id.* at 17–18 (citing Ex. 1001 ¶ 42; Ex. 1009, 3)), but concedes that “[t]he Challenged Claims are unpatentable under either construction” (*id.* at 18 (citing Ex. 1001 ¶ 43)).

We determine that “consisting essentially of” is, as Petitioner contends, open to further components, but add that the further components are limited to those that do not materially affect the basic and novel properties of the composition. *PPG Indus.*, 156 F.3d at 1354; *see also AK Steel Corp. v. Sollac*, 344 F.3d 1234, 1239 (Fed. Cir. 2003). We determine that the phrase “dental restoration” encompasses “a dental appliance shaped for placement into a patient’s mouth,” as this is consistent with the ordinary meaning of the phrase and the written description in the '451 patent cited by Petitioner. Ex. 1002, Abstract, 2:36–44, 3:17–18, 5:62–65. We determine that the term “pressable” encompasses the meaning of being “able to be formed into dental articles by heat pressing or injection molding using

commercially available equipment,” as this is consistent with the ordinary meaning of the phrase and written description in the ’451 patent cited by Petitioner. *Id.* at 2:44–48. We determine that the term “blank” encompasses “a small piece of material in a form (such as a cylinder or rectangular block) suitable for further processing into a dental restoration,” as this is consistent with the ordinary meaning of the phrase and written description in the ’451 patent. *Id.* at 3:4–9, 3:17–18. We determine that the term “about” encompasses the meaning “approximately,” as this is consistent with the word’s plain and ordinary meaning, but decline to further construe the term as Petitioner urges because it is not necessary to resolve the controversy before us. *See Nidec Motor Corp.*, 868 F.3d at 1017.

C. Limited Relevance of ITC Proceeding

The parties jointly submitted the Status Report, which states that “the ITC’s determinations regarding [Petticrew and Beall] may be relevant to the Board in its analysis of the patentability of claims 1-4 and 57-61 of the ’451 patent.” Status Report, 2 (citing Ex. 1015, 13; Ex. 1016, 84–92). The parties’ submission, however, fails to identify any particular determination, or its relevance to the ’451 patent. The ’451 patent was not the subject of the determinations made by the ITC, as all asserted claims were terminated from that proceeding prior to the ID. Furthermore, the record of the ITC proceeding is manifestly different, for at least the reason that, unlike in this proceeding, Patent Owner (Complainants) contested the invalidity challenges raised at the ITC. Claim construction differs in that the *Phillips* standard applies to the ITC proceeding and, in this proceeding, we apply the broadest reasonable interpretation, as discussed above, limiting any relevance of the Commission’s determinations to this proceeding. *See, e.g.*,

Ex. 1016, 8 (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc)). The proof required for invalidity at the ITC and unpatentability at the Board also differs. Establishing invalidity in an ITC proceeding requires clear and convincing evidence. *Microsoft Corp. v. i4i Ltd. P'ship*, 131 S. Ct. 2238, 2242 (2011). Establishing unpatentability in an *inter partes* review requires a preponderance of the evidence. 35 U.S.C. § 316(e). Having considered the Status Report, and cited exhibits, and the differences between the proceedings discussed above, we do not consider any determination herein to be in tension with those made by the ITC. To the extent any determination in our decision can be considered contrary to that in the ITC proceeding, we discern no error on the basis of the difference itself, and find insufficient persuasive value in the decision in the ITC proceeding itself on this record. *Cf. Texas Instruments Inc. v. Cypress Semiconductor Corp.*, 90 F.3d 1558, 1569 (Fed. Cir. 1996) (ITC decision has no preclusive effect in other forums but district court can attribute persuasive value to a prior ITC decision, as justified).

D. Relevant Legal Principles

A patent claim is unpatentable under 35 U.S.C. § 103 if the difference 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 of ordinary skill in the art to which the 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.*, 383 U.S. 1, 17–18 (1966).

The Federal Circuit has held that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *E.I. DuPont de Nemours & Co. v. Synvina CV*, 904 F.3d 996, 1006 (Fed. Cir. 2018) (quoting *In re Aller*, 220 F.2d 454, 456 (CCPA 1955)). “[W]here there is a range disclosed in the prior art, and the claimed invention falls within that range, the burden of production falls on the patentee to come forward with evidence of teaching away, unexpected results, or other pertinent evidence of nonobviousness.” *Id.* (quoting *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)); *cf. In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“[T]he existence of overlapping or encompassing ranges shifts the burden to the applicant to show that his invention would not have been obvious.”). Likewise, there is a rebuttable presumption grounded on a claimed range overlapping a range disclosed in the prior art. *E.I. DuPont de Nemours & Co.*, 904 F.3d at 1007 (quoting *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1311 (Fed. Cir. 2006)) (“The presumption [of obviousness] can be rebutted if it can be shown that the prior art teaches away from the claimed range, or the claimed range produces new and unexpected results.”); *cf. Peterson*, 315 F.3d at 1330–31 (discussing role of evidence of unexpected results or criticality and teaching away in rebutting a *prima facie* case of obviousness in examination of an application). In sum,

“where there is a range disclosed in the prior art, and the claimed invention falls within that range, the burden of production falls upon the patentee to come forward with evidence of teaching away, unexpected results or criticality, or

other pertinent objective indicia indicating that the overlapping range would not have been obvious in light of that prior art.

E.I. DuPont de Nemours & Co., 904 F.3d at 1008 (quoting *Galderma*, 737 F.3d at 738). To be clear, the burden of persuasion always lies with Petitioner, as “[t]he factfinder then assesses [the patentee’s] evidence, along with all other evidence of record, to determine whether a patent challenger has carried its burden of persuasion to prove that the claimed range was obvious.” *Id.* at 1007. “[I]n the absence of evidence indicating that there is something special or critical about the claimed range, an overlap suffices to show that the claimed range was disclosed in—and therefore obvious in light of—the prior art.” *Id.* at 1008.

E. Obviousness of Claims 1 and 3 Over Beall

Petitioner asserts that claims 1 and 3 of the ’451 patent are unpatentable as obvious over Beall. Pet. 23–31.

1. Beall (Ex. 1004)

Beall is titled “Lithium Disilicate-Containing Glass-Ceramics Some of Which are Self-Glazing” and discloses glass-ceramic articles formed of compositions “consisting essentially . . . of 8–19% Li_2O , . . . 0–7% K_2O , . . . 0–11% Al_2O_3 , . . . 65–80% SiO_2 , and . . . [optionally] 1.5–7% P_2O_5 .” Ex. 1004, Abstract, 2:5–11.

2. Analysis

Petitioner relies on Beall’s disclosure of ranges of components that overlap the claimed ranges. Pet. 23–30 (citing Ex. 1004, 2:5–9; Ex. 1001 ¶¶ 58–67, 69–70, 73–74). Because the relied-on compositions are limited to the recited components in amounts according to the claims, there is no need to determine to what degree “consisting essentially of” is open to other

components. As Petitioner contends, the recited ranges “at a minimum overlap the claimed range, if the claimed ranges are not entirely subsumed in the prior art ranges.” *Id.* at 25.

As to claim 1, Petitioner sets forth how the disclosed broad ranges of components support a case for obviousness of the claimed composition on the basis of overlapping or encompassing ranges. Petitioner contends that “the first five limitations recite components that must be present in amounts within the recited ranges,” that “[t]he remaining 17 limitations recite additional components that may optionally be present in amounts ‘up to about’ a certain weight limit,” and that “Beall discloses broad ranges for components that overlap the claimed ranges.” *Id.* at 23 (citing Ex. 1002, 11:49–12:8; Ex. 1004, 2:5–9; Ex. 1001 ¶¶ 57–58). Petitioner highlights that the claimed range for each component required, i.e., SiO₂, Al₂O₃, Li₂O, K₂O, and P₂O₅, is encompassed by the explicit ranges, or nearly so if the lower bound of about 64% SiO₂ is not fully met by Beall’s disclosed lower bound of 65%. *Id.* at 23–25. Petitioner maintains that “the existence of overlapping or encompassing ranges shifts the burden to the applicant to show that his invention would not have been obvious.” *Id.* at 25 (quoting *Peterson*, 315 F.3d at 1330).

Petitioner contends that there is no evidence of record rebutting the case for obviousness. Petitioner maintains that while “an applicant may overcome a *prima facie* case of obviousness by establishing ‘that the [claimed] range is critical,’ . . . [h]ere, there is no evidence establishing criticality of the claimed ranges.” *Id.* at 25–26 (quoting *Peterson*, 315 F.3d at 1330). Petitioner highlights that “[t]here is nothing in the patent or

prosecution history to suggest that the selected ranges . . . lead to anything unexpected compared to the broader ranges disclosed in Beall.” *Id.* at 26.

On this record, the case for the obviousness of claim 1 based on encompassing or overlapping ranges stands unrebutted in the absence of any response by Patent Owner. As set forth in Beall, it is known to use the disclosed encompassing or overlapping ranges of the components required by the claim to prepare glass-ceramic articles. Weighing the evidence, we determine that a preponderance of the evidence supports Petitioner’s assertion that the glass-ceramic composition according to claim 1 would have been obvious. As our reviewing court has held, “[t]he point of [its] overlapping range cases is that, in the absence of evidence indicating that there is something special or critical about the claimed range, an overlap suffices to show that the claimed range was disclosed in—and therefore obvious in light of—the prior art.” *E.I. DuPont de Nemours & Co.*, 904 F.3d at 1008. Further, “it is not inventive to discover the optimum or *workable* ranges by routine experimentation.” *In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997) (quotations omitted) (emphasis added). Where the prior art discloses glass-ceramic compositions with overlapping or encompassing ranges of components, arriving at workable ranges of the components for those glass-ceramic compositions reasonably requires no more than using amounts disclosed, or rendered obvious, by the disclosed ranges. On this record, it is manifest that this is all that is required to arrive at workable ranges for these components, and that it involves nothing more than routine experimentation, which would have been within the skill of a person of ordinary skill in the art.

We determine, accordingly, that claim 1 is unpatentable for obviousness over Beall by a preponderance of the evidence of record.

As to claim 3, Petitioner again relies on the disclosed broad ranges of recited components, but also relies on an example. Petitioner contends that the broad disclosed ranges of Beall overlap the claimed ranges of the “four components [that] must be present” in the composition of claim 3—SiO₂, Al₂O₃, Li₂O, and P₂O₅. Pet. 27 (citing Ex. 1002, 11:49–12:8, 12:11–38; Ex. 1004, 2:5–9; Ex. 1001 ¶¶ 64–67). Petitioner highlights that “[c]laim 3 differs with respect to claim 1 in that the amount of Al₂O₃ has been changed to 5.2-9%”—from about 1.5 to about 6%—and K₂O is optional. *Id.* (citing Ex. 1001 ¶¶ 64–65; Ex. 1004, 2:5–9; Ex. 1002, 11:49–12:8, 12:11–38). Beall’s Example 7 includes 71.7% SiO₂, 9.49% Al₂O₃, 9.47% Li₂O, 5.48% P₂O₅, 1.08% CaO, and 2.49% ZrO₂, while the corresponding ranges in claim 3 are “about 64 to about 70% SiO₂,” “about 5.2 to about 9[%] Al₂O₃,” “about 10 to about 15% Li₂O,” “about 2 to about 7% P₂O₅,” “up to about 0.9% CaO,” and “up to about 3% ZrO₂.” *Id.* at 27–29.

Petitioner contends that “[f]or the same reasons discussed above with respect to claim 1, claim 3 also is *prima facie* obvious” on the basis of Beall’s disclosed ranges encompassing or overlapping the claimed ranges. *Id.* at 29 (citing *Peterson*, 315 F.3d at 1330). Petitioner again highlights that there is no evidence of record rebutting the case for obviousness. *Id.* at 29–30.

As to Beall’s Example 7, Petitioner contends “claim 3 would have been obvious considering the closeness of Example 7 to the end points of the claimed ranges” and relies on the position that a person of ordinary skill in the art would have expected that Example 7 would “have the same

properties as a glass ceramic composition falling within the claimed ranges.” Pet. 30 (citing *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 783 (Fed. Cir. 1985); Ex. 1001 ¶ 70). In *Titanium Metals*, an alloy “having 0.8% nickel, 0.3% molybdenum, up to 0.1% maximum iron, balance titanium” was found obvious over disclosed alloys of 0.75% nickel, 0.25% molybdenum, balance titanium and of 0.94% nickel, 0.31% Mo, balance titanium because “the proportions are so close that *prima facie* one skilled in the art would have expected them to have the same properties . . . [and] Appellee produced no evidence to rebut that *prima facie* case.” *Titanium Metals*, 778 F.2d at 776, 783.

On this record, the case for the obviousness of claim 3 based on encompassing or overlapping ranges stands unrebutted in the absence of any response by Patent Owner. Weighing the evidence, we determine that a preponderance of the evidence supports Petitioner’s assertion that the glass-ceramic composition according to claim 3 would have been obvious in light of Beall’s disclosure of glass-ceramic compositions with overlapping or encompassing ranges of components, for the same reasons as claim 1, discussed above.

Further, as to the case grounded on Beall’s Example 7, there is unrebutted testimony by Dr. Clark that a person of ordinary skill in the art “would have expected Beall’s Example 7 to have the same properties as a glass ceramic composition falling within the claimed ranges in claim 3” (Ex. 1001 ¶ 70), which we also find sufficient given the correspondence to the circumstances in *Titanium Metals*, both as to the relative variance of the disclosed composition from that claimed and the lack of rebutting evidence. In *Titanium Metals*, the variance of components from that in the claimed

composition includes, in one prior art alloy, 0.94% nickel versus 0.8% nickel claimed and, in another prior art alloy, 0.25% molybdenum versus 0.3% molybdenum claimed. *Titanium Metals*, 778 F.2d at 783. Here, the components in Beall's Example 7 at variance with that claimed are SiO₂ at 71.7% near the upper bound claimed of "about 70%," Al₂O₃ at 9.49% near the upper bound claimed of "about 9[%]," and CaO at 1.08% near the upper bound claimed of "about 0.9%." Pet. 29. In light of the closeness of the proportions disclosed to those claimed, the unrebutted testimony of Dr. Clark, and the lack of any other contrary evidence, we determine that a preponderance of the evidence supports Petitioner's assertion that the glass-ceramic composition according to claim 3 would also have been obvious over Beall's Example 7, in addition to over the broader disclosed ranges for components included in its glass-ceramic compositions.

We determine, accordingly, that claim 3 is unpatentable for obviousness over Beall by a preponderance of the evidence of record.

F. Obviousness of Claims 2, 4, and 57–61 over Petticrew and Beall

Petitioner asserts that claims 2, 4, and 57–61 are unpatentable as obvious over Petticrew and Beall. Pet. 31–44.

1. Petticrew (Ex. 1003)

Petticrew is titled "Method for Molding Dental Restorations and Related Apparatus" and discloses forming ceramic dental restorations, such as crowns, bridges, inlays, etc., from lithium disilicate glass-ceramic materials, including the lithium disilicate glass-ceramic materials disclosed in Beall. Ex. 1003, 1, 6, 11, 22–23, 52–53.

2. Analysis

Petitioner relies on Petticrew for disclosing dental restorations made from lithium disilicate glass ceramics, including dental restorations made from Beall's compositions. Pet. 31–32 (citing Ex. 1003, 23; Ex. 1001 ¶ 82; Ex. 1004, 9:6–10:26).

Petitioner contends that combining Petticrew with Beall would have been obvious. *Id.* at 32–33. Petitioner contends that there is explicit motivation for the combination in Petticrew's specific reference "to the Beall patent, stating '[o]ther lithium disilicate glass-ceramic materials which may be used in this invention are disclosed in U.S. Patent 5,219,799 issued June 15, 1993.'" *Id.* at 32 (quoting Ex. 1003, 23). Because Beall, i.e., U.S. Patent 5,219,799, is expressly mentioned in Petticrew, Petitioner reasonably contends that "there is 'no question' that one of ordinary skill would be led to combine the two references." *Id.* (citing *Optivus Tech., Inc. v. Ion Beam Applications S.A.*, 469 F.3d 978, 990–91 (Fed. Cir. 2006)). On this record, we agree and find that one of ordinary skill in the art would have had sufficient motivation to combine the teachings of the two references, particularly, to use the glass-ceramic materials disclosed in Beall in the dental restorations of Petticrew.

Petitioner contends that a person of ordinary skill in the art "would have had a reasonable expectation of success in forming a dental restoration from any of Beall's compositions using Petticrew's process." Pet. 32–33. Petitioner highlights that "Petticrew specifically teaches that '[l]ithium disilicate glass-ceramic materials are *particularly suited* for use in the invention" and the similarity of Beall's compositions "to those disclosed in Petticrew, particularly Tables I-III." *Id.* (citing Ex. 1003, 23); *see also*

Ex. 1003, 24–25. Petitioner highlights that Petticrew was able to form dental restorations from a variety of compositions, including an example that differs from those in Petticrew’s Tables I–III to a greater degree than Beall’s compositions relied on in the challenge as further support for one of ordinary skill in art having a reasonable expectation of success employing Beall’s compositions. Pet. 33 (citing Ex. 1001 ¶¶ 84–88; Ex. 1003, 52–53). On this record, we find that a person of ordinary skill in the art would have had a reasonable expectation of success in forming a dental restoration from any of Beall’s compositions using Petticrew’s process. “[T]he expectation of success need only be reasonable, not absolute.” *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1364 (Fed. Cir. 2007) (citing *Merck & Co. v. Biocraft Labs., Inc.*, 874 F.2d 804, 809 (Fed. Cir. 1989); *In re O’Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988)).

As to claims 2 and 4, Petitioner relies on Petticrew for meeting the further limitation, “whereby the glass-ceramic is pressable.” *Id.* at 33 (citing Ex. 1002, 12:9–10, 39–40; Ex. 1001 ¶ 90). Petitioner highlights that “Petticrew describes in detail the use of lithium disilicate glass-ceramics to form pressable dental restorations, . . . including forming ‘metal free crowns and bridges of outstanding strength and esthetic properties.’” *Id.* at 33–34 (citing Ex. 1001 ¶ 94; Ex. 1003, 22). Petitioner also highlights how Petticrew uses “a positive mechanically applied force for purposes of injecting the molten dental glass-ceramic material into the preformed mold cavity” after it was “realized that it may be possible to ***produce a satisfactory restoration by forcing a molten or plastic glass-ceramic material into a mold having a cavity in the form of the desired dental restoration.***” *Id.* at 34 (citing Ex. 1003, 3, 6; Ex. 1001 ¶¶ 92–93).

Petitioner reasonably maintains that a person of ordinary skill in the art “would understand that Petticrew’s glass-ceramic compositions were pressable at least because of its explicit disclosure of forming dental restorations by pressing plastic glass-ceramic material into a mold.” *Id.* (citing Ex. 1001 ¶¶ 94–95). Again, Patent Owner fails to direct us to any evidence to the contrary, nor do we discern such evidence on this record. On this record, accordingly, we find Petticrew to disclose pressable glass-ceramic compositions.

We determine, accordingly, that claims 2 and 4 are unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

As to claim 57, Petitioner relies on Petticrew teaching the use of Beall’s compositions to form dental restorations (*id.* at 38 (citing Ex. 1003, 23; Ex. 1001 ¶ 103)) and, as to the composition, on Beall disclosing both broad compositional ranges that overlap the claimed ranges (*id.* at 35–38 (citing Ex. 1001 ¶ 100)) and an example falling within the ranges of the recited composition (*id.* (citing Ex. 1001 ¶ 100)). *Id.* at 34–39. Petitioner relies on Petticrew as discussed above with regard to claims 2 and 4. *Compare id.* at 38–39, *with id.* at 31–33. The disclosed broad ranges relied on overlap the recited ranges in claim 57 (*see id.* at 35–38), even if not to the same degree as for claims 1 and 3 (*compare id.* at 35–37, *with id.* at 23–25, 28–29). Beall’s Example 3, as Petitioner reasonably contends, has a composition falling fully within the recited composition set forth in claim 57. *Id.* at 35–37; Ex. 1004, 9:59–67. Beall also identifies its Example 3 as “illustrat[ing] [a] composition[] capable of forming glass-ceramic articles.” Ex. 1004, 8:62–64.

On this record, accordingly, we find Petticrew to disclose the use of Beall's compositions to form dental restorations, including the particular composition of Beall's Example 3 falling within the compositional ranges recited in claim 57, as well as to suggest the use of compositions according to the compositional ranges recited in claim 57, as these are rendered obvious by Beall's disclosure of overlapping ranges.

We determine, accordingly, that claim 57 is unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

As to claim 58, depending from claim 57, Petitioner relies on Petticrew for meeting the further limitation that the dental restoration is formed into a component selected from an enumerated listing that includes, for example, crowns, bridges, and onlays. *Id.* at 39–40 (citing Ex. 1002, 19:1–6; Ex. 1001 ¶ 106). Petitioner highlights that Petticrew specifically discloses that its “invention relates to a process for the molding of metal free dental restorations such as crowns, bridges, inlays, onlays, etc. from glass-ceramic materials” (*id.* at 40 (quoting with emphasis Ex. 1003, 1); Ex. 1001 ¶¶ 107–108) and that Petticrew explicitly instructs the use of “Beall's compositions for a dental restoration” (Pet. 40 (citing Ex. 1001 ¶ 109; Ex. 1003, 23)). Petitioner reasonably contends that one of ordinary skill in the art would have been motivated to make one of the enumerated dental restorations from Beall's composition. *Id.* (citing Ex. 1003, 23; Ex. 1001 ¶¶ 109–110).

On this record, we find Petticrew teaches making particular dental restorations, i.e., crowns, bridges, inlays, and onlays, recited in claim 58, and to do so using compositions according to Beall. As discussed above, the

composition of claim 57, from which claim 58 depends, is rendered obvious by Beall.

We determine, accordingly, that claim 58 is unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

Claim 59 recites a “blank for machining the dental restoration of claim 57.” *Id.* (citing Ex. 1002, 19:7–8; Ex. 1001 ¶ 111). Petitioner contends that the limitation would have been obvious because the “feature is implicit in Beall’s statement that the glass-ceramic can be ‘melted in large commercial melting units and formed into desired shapes via conventional glass melting and forming practice’” and that “it was well known in the art at the time that dental restorations may be formed by pressing or machining.” *Id.* at 41–42 (citing Ex. 1001 ¶¶ 114–116; Ex. 1004, 9:15–20; Ex. 1008, 138; Ex. 1010, 5:24–27; Ex. 1011, 23–24). On this basis, Petitioner and Dr. Clark contend that “it would have been obvious for a [person of ordinary skill in the art] to form Beall’s compositions into a shape that is easy for machining” into a dental restoration. *Id.* at 42; Ex. 1001 ¶¶ 114–116.

On this record, including the unrebutted testimony of Dr. Clark, the preponderance of evidence supports Petitioner’s contention that Beall’s statement referring to “conventional glass melting and forming practice” would be understood by the skilled artisan to include machining and that, as such, Beall reasonably discloses forming a blank for machining into its final desired form. “[I]n considering the disclosure of a reference, 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) (finding a reference to anticipate claims based in part on what a skilled artisan would infer from the disclosure); *see also In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976) (“the question under 35 U.S.C. [§] 103 is not merely what the references expressly teach, but what they would have suggested to one of ordinary skill in the art”). Where the final desired form is a dental restoration, the combination of Petticrew and Beall reasonably suggests forming a blank for machining into a dental restoration. Further, on this record, we find that a blank of the recited composition of the base claim, however that blank is to be formed into its final desired form, reasonably meets the claim limitation because a preponderance of the evidence indicates that like glass-ceramic materials can be machined. *See, e.g.*, Ex. 1001 ¶ 115; Ex. 1008, 138; Ex. 1010, 5:24–27; Ex. 1011, 18–32.

We determine, accordingly, that claim 59 is unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

Claim 60 recites “[a] dental restoration comprising the glass-ceramic of claim 1.” Pet. 42 (citing Ex. 1002, 19:9–10; Ex. 1001 ¶ 117). Petitioner relies on Petticrew as explicitly disclosing the application of Beall’s compositions to dental restorations and on the recited composition being obvious, as set forth in the petition in Sections VI.A (Beall applied to claim 1) (*id.* at 23–27) and VII.C (Petticrew and Beall applied to claim 57) (*id.* at 34–39), both discussed above (*id.* at 42 (citing Ex. 1001 ¶¶ 118–119)).

On this record, as discussed above, we find Petticrew teaches making dental restorations using compositions according to Beall, and determine that the composition recited in claim 1 is obvious in light of Beall’s

disclosed compositional ranges that encompass or overlap the recited composition of claim 1. It follows also that the combination would have led a person of ordinary skill in the art to dental restorations of the claimed composition.

We determine, accordingly, that claim 60 is unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

As to claim 61, Petitioner again relies on Petticrew teaching the use of Beall's compositions to form dental restorations and, as to the composition, on Beall disclosing both broad ranges that overlap the claimed ranges and an example falling within the ranges of the recited composition. *Id.* at 42–44 (citing Ex. 1003, 23; Ex. 1004, 2:5–9, 9:59–10:7; Ex. 1001 ¶¶ 120–124). Notably, as highlighted by Petitioner, claim 61 uses the transitional term “comprising” and is thus open to additional components beyond those recited in the claim. *Id.* at 42–43 (citing Ex. 1001 ¶¶ 120, 122; Ex. 1002, 19:11–16). Petitioner relies on Petticrew as discussed above with regard to claims 2 and 4. *Compare id.* at 43–44, *with id.* at 31–33, 38–39. Petitioner relies on the disclosed broad ranges in Beall that overlap the recited ranges of enumerated components—SiO₂, Al₂O₃, Li₂O, and P₂O₅—in claim 61 (*id.* at 43), in the same manner as for claim 3 (*compare id.*, *with id.* at 28–29). Petitioner also relies on Beall's Example 4 that, Petitioner reasonably contends on this record, falls fully within the recited composition set forth in claim 61. *Id.* at 43; Ex. 1004, 9:59–67. While Beall's Example 4 also includes 4.67% CaO and 2.4% ZrO₂ (Ex. 1004, 9:59–67), claim 61 does not limit these components, as “comprising” is open to their inclusion.

On this record, including the unrebutted testimony of Dr. Clark, we find by a preponderance of the evidence that Petticrew discloses the use of Beall's compositions to form dental restorations, including the particular composition of Beall's Example 4 falling within the compositional ranges recited in claim 61, as well as to suggest the use of compositions according to the compositional ranges recited in claim 61, as these are rendered obvious by Beall's disclosure of overlapping (or encompassing) ranges.

We determine, accordingly, that claim 61 is unpatentable for obviousness over Petticrew and Beall by a preponderance of the evidence of record.

G. Obviousness of Claim 3 Over Echeverria and of Claims 4, 57–59, and 61 over Petticrew and Echeverria

Petitioner asserts that claim 3 is unpatentable as obvious over Echeverria and that claims 4, 57–59, and 61 are unpatentable as obvious over Petticrew and Echeverria. Pet. 44–56.

Echeverria is titled “New Lithium Disilicate Glass-Ceramics” and discloses a lithium disilicate-containing glass-ceramic of 74.2% SiO₂, 3.54% Al₂O₃, 15.4% Li₂O, 3.25% K₂O, and 3.37% P₂O₅ (Glass D) and of 68.6% SiO₂, 2.01% ZrO₂, 8.56% Al₂O₃, 1.01% CaO, 11.2% Li₂O, and 4.18% P₂O₅ (Glass E). Ex. 1005, 184.

Petitioner relies on Echeverria's disclosure of particular glass-ceramic compositions. Pet. 44–47, 50–52, 55–56. Petitioner relies on Petticrew for disclosing dental restorations made from lithium disilicate glass-ceramics, for identifying lithium disilicate glass-ceramics as the preferred material for use, and for various recited properties. *Id.* at 49–50, 53–55.

The grounds based on Beall and Petticrew in combination with Beall are dispositive as to all challenged claims, while those based on Echeverria and Petticrew in combination with Echeverria are not. We decline, accordingly, to reach the grounds based on Echeverria and Petticrew in combination with Echeverria. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”).

III. CONCLUSION³

For the foregoing reasons, we conclude that Petitioner has established, by a preponderance of the evidence that claims 1–4 and 57–61 are unpatentable.

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 3	103	Beall	1, 3	
2, 4, 57–61	103	Petticrew, Beall	2, 4, 57–61	
3	103	Echeverria		
4, 57–59, 61	103	Petticrew, Echeverria		
Overall Outcome			1–4, 57–61	

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

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1–4 and 57–61 of the '451 patent are *unpatentable*; and

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

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