

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*.

DECISION
Institution of *Inter Partes* Review
35 U.S.C. § 314(a)

I. INTRODUCTION

GC Corporation and GC America, Inc. (collectively “Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–4 and 57–61 of U.S. Patent No. 6,455,451 B1 (“the ’451 patent,” Ex. 1002). Paper 1 (“Pet.”). Ardent, Inc., the owner of the ’451 patent, did not file a Patent Owner Preliminary Response.

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314(b); 37 C.F.R. § 42.4(a). To institute an *inter partes* review, we must determine that the information presented in the Petition shows that there is “a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). Applying that standard, for the reasons set forth below, we institute an *inter partes* review on all challenged claims and grounds.

II. BACKGROUND

A. *Related Proceedings*

The parties indicate that the ’451 patent is the subject of litigation in *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, U.S. International Trade Commission.¹ Pet. 56–57; Paper 3, 2.

¹ The ’451 patent was apparently terminated from Investigation No. 337-TA-1050 on February 22, 2018 (Inv. No. 337-TA-1050, Initial Determination issued July 23, 2018, 3), prior to the Petition being filed on April 17, 2018 (Pet. 58).

The parties also identify an additional petition concurrently filed by Petitioner for review of related U.S. Patent No. 6,802,894—IPR2018-00940. Paper 3, 2.

B. The '451 Patent (Ex. 1002)

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.

C. Challenged 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 part² 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 3% ZrO₂;

....

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

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;

....

² 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.

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.

D. The Asserted Grounds of Unpatentability

Petitioner asserts that claims 1–4 and 57–61 of the ’451 patent are unpatentable under 35 U.S.C. § 103 as follows:

Ground	References	Claims
1	Beall ³	1 and 3
2	Petticrew ⁴ + Beall	2, 4, and 57–61
3	Echeverria ⁵	3
4	Petticrew + Echeverria	4, 57–59, and 61

³ Beall et al., U.S. Patent No. 5,219,799, issued June 15, 1993 (Ex. 1004).

⁴ Petticrew, WO 95/32678, published December 7, 1995 (Ex. 1003).

⁵ L. M. Echeverria, *New Lithium Disilicate-Glass Ceramics*, BOL. DE LA SOC. ESP. DE CERAMICA, 183:188, 1992 (Ex. 1005).

Petitioner contends each reference is prior art under 35 U.S.C.
§ 102(b). Pet. 13–14.

Petitioner supports the Petition with the testimony of Dr. Arthur E.
Clark (Ex. 1001).

III. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner contends that

A person of ordinary skill in the art (POSITA), during the period from 1998-2002, would have had knowledge and experience relating to the design, production and use of glass-ceramic compositions for various applications. Such a person 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. The person of ordinary skill in the art 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).

On this record, we adopt Petitioner's definition of the level of ordinary skill. We further note that the prior art itself demonstrates 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 on the level of skill in the art . . . [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, 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) (2016).⁶ 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.”

⁶ The broadest reasonable construction standard applies to *inter partes* reviews filed before November 13, 2018. 77 Fed. Reg. 48727 (Aug. 14, 2012) (codified at 37 C.F.R. § 42.100(b)), as amended at 81 Fed. Reg. 18766 (Apr. 1, 2016); *see also* 83 Fed. Reg. 51340 (Oct. 11, 2018) (changing the standard for interpreting claims in *inter partes* reviews filed on or after November 13, 2018).

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). 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, 17–18). The term “about” is contended to mean “approximately.” *Id.* (citing Ex. 1001 ¶ 40). 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 decline to construe these claim terms beyond the limited extent we do so below in our analysis, because it is not necessary to do so in reaching our decision that Petitioner has established a reasonable likelihood that it would prevail in establishing the unpatentability of at least one challenged claim.

C. Overview of Prior Art

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. 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.

3. Echeverria (Ex. 1005)

Echeverria is titled “New Lithium Disilicate Glass-Ceramics” and discloses a lithium disilicate-containing glass-ceramic of 74.2% SiO_2 , 3.54% Al_2O_3 , 15.4% Li_2O , 3.25% K_2O , and 3.37% P_2O_5 (Glass D) and of 68.6% SiO_2 , 2.01% ZrO_2 , 8.56% Al_2O_3 , 1.01% CaO , 11.2% Li_2O , and 4.18% P_2O_5 (Glass E). Ex. 1005, 184.

D. Obviousness of Claims 1 and 3 over Beall

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. Petitioner contends that 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. 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 *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003)).

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 (citing *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.

The case for obviousness based on encompassing or overlapping ranges shifts the burden of production to the patentee to rebut the case, and this is applicable in the *inter partes* review context. See *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, No. 2017-1977, 2018 WL 4390796, at *8 (Fed. Cir. Sept. 17, 2018). “[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)). Likewise, there is a rebuttable presumption grounded on a claimed range overlapping a range disclosed in the prior art. *Id.* (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.”).

On this record, the case for obviousness based on encompassing or overlapping ranges stands unrebutted in the absence of any response by Patent Owner.

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). 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 claimed ranges are “about 64 to about 70% SiO₂,”

“about 5.2 to about 9[%] Al_2O_3 ,” “about 10 to about 15% Li_2O ,” “about 2 to about 7% P_2O_5 ,” “up to about 0.9% CaO ,” and “up to about 3% ZrO_2 .” *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 on a person of ordinary skill in the art expecting 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 America 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.

Relying on “about” being “construed as ± 2 units in the least significant figure position” (Pet. 17–18 (citing Ex. 1001 ¶ 42; Ex. 1009, 3)), Petitioner also contends that Beall’s Example 7 falls “within the numerical

range as augmented by ‘about’” (*id.* at 27 (citing Ex. 1004, 10:1–8; Ex. 1001 ¶ 68); *see also id.* at 30–31 (citing Ex. 1001 ¶¶ 71–72)).

On this record, it is not necessary to determine whether “about” has a meaning encompassing “ ± 2 units in the least significant figure position” to resolve the controversy because, as discussed above, there is an unrebutted case for obviousness grounded on encompassing or overlapping ranges.

Nidec Motor, 868 F.3d at 1017; *see also U.S. Surgical*, 103 F.3d at 1568.

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

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. 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 (citing Ex. 1003, 23). Because Beall 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)).

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).

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).

As to claim 57, Petitioner 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 than overlap the claimed ranges and an example falling within the ranges of the recited composition. *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. Petitioner relies on the disclosed broad ranges that overlap the recited ranges in claim 57 (*see id.* at 35–38), which do overlap, but not to the same degree as for claims 1 and 3 (*compare id.* at 35–37, *with id.* at 23–25, 28–29). Petitioner also relies on Beall’s Example 3 that, it reasonably contends on this record, falls fully within the recited composition set forth in claim 57. *Id.* at 35–37.

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).

Claim 59 recites a “blank for machining the dental restoration of claim 57.” *Id.* (citing Ex. 1002, 19:78; 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).

Claim 60 recites “[a] dental restoration comprising the glass-ceramic of claim 1.” *Id.* at 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) and VII.C (Petticrew and Beall applied to claim 57), discussed above. *Id.* (citing Ex. 1001 ¶¶ 118–119).

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. 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 (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 in claim 61 (*id.* at 43), which overlap in the same manner as for claim 3 (*compare id.*, *with id.* at 28–29). Petitioner also relies on Beall’s Example 4 that, it reasonably contends on this record, falls fully within the recited composition set forth in claim 61. *Id.* at 43.

F. Obviousness of Claim 3 over Echeverria

Petitioner relies on Echeverria’s disclosure of a particular glass-ceramic composition, as well as a further disclosure relating to the range for CaO for such compositions. *Id.* at 44–47. As highlighted by Petitioner, claim 3 requires four components be included in specified amounts—SiO₂, Al₂O₃, Li₂O₅, and P₂O₅—and is open to up to specified amounts of further components, including CaO and ZrO₂. *Id.* at 44–45. Petitioner contends that “Example E in Echeverria falls almost if not entirely within the explicit range of claim 3 (only CaO with 1.01% could possibly be argued to be outside the claimed ‘up to about 0.9%’ range).” *Id.* at 45 n.4. Petitioner contends claim 3 would have been obvious considering the closeness of Example E (1.01% CaO) to the recited end point of CaO (“up to about 0.9% CaO”) and the expectation that “Example E would have the same properties as a glass ceramic composition falling within the claimed ranges.” *Id.* at 47 (citing *Titanium Metals*, 778 F.2d at 783; Ex. 1001 ¶ 79). Petitioner also contends that “Echeverria provides ample motivation or suggestion to a [person of ordinary skill in the art] to adjust a glass-ceramics composition within the ranges stated in the article,” including a disclosed range of 0–5 wt% CaO. *Id.* (citing Ex. 1005, 187).

Petitioner also relies on “about” being “construed as ± 2 units in the least significant figure position” (*compare id.* at 46–47, *with id.* at 17–18 (citing Ex. 1001 ¶ 42; Ex. 1009, 3)). On this record, it is not necessary to determine whether “about” has a meaning encompassing “ ± 2 units in the least significant figure position” to resolve the controversy, because Petitioner has reasonably established a case for obviousness grounded on the plain meaning of the claim terms that stands unrebutted.

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

Petitioner relies on Petticrew for disclosing dental restorations made from lithium disilicate glass-ceramics, and for identifying lithium disilicate glass-ceramics as the preferred material for use. Pet. 48 (citing Ex. 1003, 23). Petitioner contends that “Petticrew itself suggests that Echeverria’s compositions could easily be used in Petticrew’s disclosed methods.” *Id.* at 47–48 (citing Ex. 1001 ¶ 127).

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 Echeverria’s compositions using the Petticrew process because Petticrew specifically teaches that “[l]ithium disilicate glass-ceramic materials are *particularly suited* for use in the invention” and the similarity of Echeverria’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 Echeverria’s compositions relied on in the challenge as further support for one of ordinary skill in art having a

reasonable expectation of success employing Echeverria's compositions.
Pet. 48–49 (citing Ex. 1001 ¶ 128; Ex. 1003, 52–53).

As to claim 4, Petitioner relies on both Petticrew and Echeverria for meeting the further limitation, “whereby the glass-ceramic is pressable.” *Id.* at 49–50 (citing Ex. 1002, 12:39–40; Ex. 1001 ¶ 90). For Pettigrew, Petitioner refers to the Petition, Section VII.B (Petticrew and Beall applied to claims 2 and 4), discussed above. *Id.* at 49 (citing Ex. 1001 ¶¶ 90–96, 132). For Echeverria, Petitioner highlights that “Echeverria discloses ‘[t]he low viscosity and liquidus simplified delivery and forming of these glasses, and allows diverse forming techniques’ . . . [and] that ‘[t]he precursor glasses have low viscosities, and are amenable to a variety of forming techniques.’” *Id.* at 49 (citing Ex. 1005, 184, 187; Ex. ¶ 130). Petitioner contends that a person of ordinary skill in the art at the time of the invention would have understood that such compositions “would be able to be formed through pressing using commercially equipment” and that they “would have known that at least from Petticrew.” *Id.* at 49–50 (citing Ex. 1005, 184, 187; Ex. 1001 ¶ 131).

As to claim 57, Petitioner maintains that “it would have been obvious to use Echeverria's compositions to form dental restorations in accordance with Petticrew's disclosure,” as set forth in the Petition, Section IX.A (combining Petticrew with Echeverria), discussed above. *Id.* at 52–53 (citing Ex. 1001 ¶¶ 127–128). As to the composition recited, Petitioner relies on Echeverria's Example D as its composition falls within the recited numerical ranges. *Id.* at 50–52 (citing Ex. 1002, 18:41–67; Ex. 1001 ¶¶ 134–136).

As to claim 58, Petitioner relies on Petticrew in the same manner as for the combination of Petticrew and Beall. *Compare id.* at 53, *with id.* at 39–40. Petitioner contends that it would have been obvious to use Echeverria’s compositions on the basis of earlier argument in the Petition, Section IX.A, discussed above. *Id.* at 53.

Claim 59 recites a “blank for machining the dental restoration of claim 57.” *Id.* at 53–54 (citing Ex. 1002, 19:7–8; Ex. 1001 ¶ 144). Petitioner contends that “[a]lthough neither Petticrew nor Echeverria contain an explicit description of machining a dental restoration from a blank, it would have been obvious to a [person of ordinary skill in the art] to do so.” *Id.* at 54 (citing Ex. 1001 ¶ 145). Petitioner contends that, informed by Echeverria that its compositions are “useful in a variety of forming techniques,” a person of ordinary skill in the art “would have understood that a ‘variety of forming techniques’ certainly includes forming a shape by machining.” *Id.* (citing Ex. 1001 ¶ 146; Ex. 1005, 187; Ex. 1008, 138; Ex. 1010, 5:24–27; Ex. 1011, 23–24). Petitioner also contends that “it would be obvious for a [person of ordinary skill in the art] to form Echeverria’s compositions into a shape that is easy for machining” because “Petticrew expressly teaches that ‘[l]ithium disilicate glass-ceramic materials are *particularly suited* for use in the invention” (emphasis in original) and identified compositions for use from Beall are similar to Echeverria’s, and that “it was well known in the art at the time that dental restorations may be formed by pressing or machining.” *Id.* at 54–55 (citing Ex. 1001 ¶¶ 146–148; Ex. 1003, 23; Ex. 1008, 138; Ex. 1010, 5:24–27; Ex. 1011, 23–24).

As to claim 61, Petitioner contends that “it would have been obvious to use Echeverria’s compositions to form dental restorations, . . . in

accordance with Petticrew’s disclosure” on the basis of earlier argument in Section IX.A of the Petition. Pet. 55–56 (citing Ex. 1001 ¶¶ 127–128, 153). As to the composition recited, Petitioner relies on Echeverria’s disclosure of ranges of components overlapping with the claimed ranges recited in claim 61, which, using the open-ended transitional term “comprising,” is open to additional components, and on Echeverria’s Example E, which has a composition falling exactly within claim 61’s recited ranges. *Id.* (citing Ex. 1001 ¶¶ 151–152, 154; Ex. 1005, 184, 187).

IV. CONCLUSION

After considering the evidence and arguments presented in the Petition, including its supporting testimonial evidence, we determine that the Petition shows a reasonable likelihood that the Petitioner would prevail with respect to at least 1 of the claims challenged in the Petition, and we institute on all challenged claims and all grounds.

V. ORDER

For the reasons given, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is instituted as to claims 1–4 and 57–61 of the ’451 patent on all asserted grounds of unpatentability, and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this Decision.

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